

# NAVAL POSTGRADUATE SCHOOL

## Monterey, California



## THESIS

### A CASE STUDY OF THE ARMY REVERSE AUCTION

by

Gary D. Stephens

June 2001

Thesis Advisor:  
Associate Advisor:

E. Cory Yoder  
Lee Edwards

Approved for public release; distribution is unlimited.

20011128 018

<b>REPORT DOCUMENTATION PAGE</b>			<i>Form Approved OMB No. 0704-0188</i>	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.				
<b>1. AGENCY USE ONLY (Leave blank)</b>		<b>2. REPORT DATE</b> June 2001	<b>3. REPORT TYPE AND DATES COVERED</b> Master's Thesis	
<b>4. TITLE AND SUBTITLE:</b> Title (Mix case letters) A Case Study of the Army Reverse Auction			<b>5. FUNDING NUMBERS</b>	
<b>6. AUTHOR(S)</b> Gary D. Stephens			<b>8. PERFORMING ORGANIZATION REPORT NUMBER</b>	
<b>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)</b> Naval Postgraduate School Monterey, CA 93943-5000			<b>10. SPONSORING / MONITORING AGENCY REPORT NUMBER</b>	
<b>9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b> N/A				
<b>11. SUPPLEMENTARY NOTES</b> The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.				
<b>12a. DISTRIBUTION / AVAILABILITY STATEMENT</b> Approved for public release; distribution is unlimited.			<b>12b. DISTRIBUTION CODE</b>	
<b>13. ABSTRACT (maximum 200 words)</b> Acquisition reform has attempted to change the procurement process over the past several years. Some believe the reform measures have been changes in policy or revisions of a paperwork process. The draw down of the workforce and financial constraints demand acquisition professionals conduct business in a smarter, more efficient manner. The technology today provides Internet platforms that allow the commercial marketplace to take advantage of electronic commerce. The Army has implemented a reverse auction program designed to capture many of the practices in use in the commercial industry. Foremost, dynamic pricing replaces fixed pricing models observed in traditional procurement strategies. Reverse auctions offer the Government the means to replicate a successful commercial practice that is becoming the accepted way of doing business. This thesis reviews performance of the Army's Reverse Auction pilot program after its first year of use. Three buying cases and 40 other reverse auctions are reviewed. The comparative analysis identifies commonalities for success and differences between past experiences with the reverse auction. The thesis concludes acquisitions for items that resemble commercial products and based on price are most successful in reverse auctions. The 43 auctions reviewed resulted in \$1,606,395 saved. The mean savings was 21.83% for the auctions reviewed.				
<b>14. SUBJECT TERMS</b> Acquisition Reform, Reverse Auction, Pricing			<b>15. NUMBER OF PAGES</b> 96	
			<b>16. PRICE CODE</b>	
<b>17. SECURITY CLASSIFICATION OF REPORT</b> Unclassified	<b>18. SECURITY CLASSIFICATION OF THIS PAGE</b> Unclassified	<b>19. SECURITY CLASSIFICATION OF ABSTRACT</b> Unclassified	<b>20. LIMITATION OF ABSTRACT</b> UL	

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)  
Prescribed by ANSI Std. Z39-18

THIS PAGE INTENTIONALLY LEFT BLANK

Approved for public release; distribution in unlimited.

**A CASE STUDY OF THE ARMY REVERSE AUCTION**

Gary D. Stephens  
Major, United States Army  
B.S., Murray State University, 1988

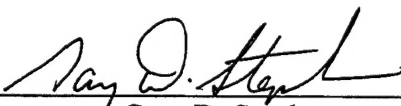
Submitted in partial fulfillment of the  
requirements for the degree of

**MASTER OF SCIENCE IN MANAGEMENT**

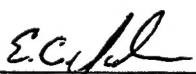
from the


**NAVAL POSTGRADUATE SCHOOL  
June 2001**

Author:

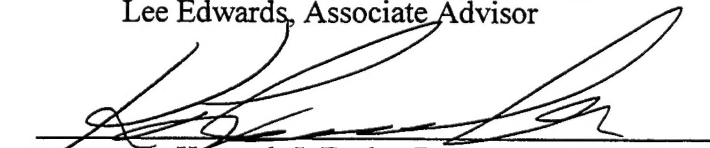
  
\_\_\_\_\_  
Gary D. Stephens

Approved by:

  
\_\_\_\_\_  
E. Cory Yoder, Thesis Advisor

  
\_\_\_\_\_

Lee Edwards, Associate Advisor

  
\_\_\_\_\_

Kenneth J. Euske, Dean  
Graduate School of Business and Public Policy



THIS PAGE INTENTIONALLY LEFT BLANK

## ABSTRACT

Acquisition reform has attempted to change the procurement process over the past several years. Some believe the reform measures have been changes in policy or revisions of a paperwork process. The draw down of the workforce and financial constraints demand acquisition professionals conduct business in a smarter, more efficient manner. The technology today provides Internet platforms that allow the commercial marketplace to take advantage of electronic commerce. The Army has implemented a reverse auction program designed to capture many of the practices in use in the commercial industry. Foremost, dynamic pricing replaces fixed pricing models observed in traditional procurement strategies. Reverse auctions offer the Government the means to replicate a successful commercial practice that is becoming the accepted way of doing business. This thesis reviews performance of the Army's Reverse Auction pilot program after its first year of use. Three buying cases and 40 other reverse auctions are reviewed. The comparative analysis identifies commonalities for success and differences between past experiences with the reverse auction. The thesis concludes acquisitions for items that resemble commercial products and based on price are most successful in reverse auctions. The 43 auctions reviewed resulted in \$1,606,395 saved. The mean savings was 21.83% for the auctions reviewed.

THIS PAGE INTENTIONALLY LEFT BLANK

## TABLE OF CONTENTS

<b>I.</b>	<b>INTRODUCTION.....</b>	<b>1</b>
<b>A.</b>	<b>PURPOSE.....</b>	<b>1</b>
<b>B.</b>	<b>BACKGROUND .....</b>	<b>1</b>
<b>C.</b>	<b>RESEARCH QUESTIONS.....</b>	<b>3</b>
1.	Primary Research Question.....	3
2.	Secondary Research Questions.....	3
<b>D.</b>	<b>METHODOLOGY .....</b>	<b>3</b>
<b>E.</b>	<b>SCOPE AND ORGANIZATION .....</b>	<b>3</b>
<b>F.</b>	<b>EXPECTED BENEFITS OF THIS THESIS .....</b>	<b>5</b>
<b>II.</b>	<b>BACKGROUND .....</b>	<b>7</b>
<b>A.</b>	<b>INTRODUCTION.....</b>	<b>7</b>
<b>B.</b>	<b>BACKGROUND .....</b>	<b>7</b>
<b>C.</b>	<b>AUCTIONS .....</b>	<b>10</b>
1.	History.....	10
2.	Types of Auctions.....	11
3.	Reverse Auctions.....	13
4.	Legality Issues .....	15
<b>D.</b>	<b>ARMY REVERSE AUCTION .....</b>	<b>16</b>
1.	Background .....	16
2.	Initial Demonstrations .....	17
3.	Process.....	18
4.	Future.....	21
<b>E.</b>	<b>PRICING ENVIRONMENT .....</b>	<b>21</b>
1.	Definition .....	21
2.	Strategies.....	22
3.	Government Pricing Objective .....	24
4.	Price Analysis .....	26
5.	Dynamic Pricing.....	26
<b>F.</b>	<b>SUMMARY .....</b>	<b>28</b>
<b>III.</b>	<b>DATA SUMMARY.....</b>	<b>31</b>
<b>A.</b>	<b>INTRODUCTION.....</b>	<b>31</b>
<b>B.</b>	<b>CASE 1.....</b>	<b>31</b>
1.	Description.....	31
2.	Quantity .....	32
3.	Opening/Final Bid Price.....	32
4.	Time Period for Auction.....	32
5.	Vendors .....	33
6.	Time Issues .....	34
<b>C.</b>	<b>CASE 2.....</b>	<b>34</b>
1.	Description.....	35

2.	Quantity .....	36
3.	Opening/Final Bid Price .....	36
4.	Time Period for Auction .....	37
5.	Vendors .....	38
6.	Time Issues .....	39
D.	CASE 3 .....	39
1.	Description .....	39
2.	Quantity .....	40
3.	Opening/Final Bid Price .....	40
4.	Time Period for Auction .....	41
5.	Vendors .....	41
6.	Time Issues .....	42
E.	CONSOLIDATED REVERSE AUCTION DATA .....	43
F.	SUMMARY .....	47
IV.	ANALYSIS .....	49
A.	INTRODUCTION .....	49
B.	ITEM DESCRIPTION .....	49
C.	QUANTITY .....	51
D.	MAXIMUM BID DETERMINATION .....	52
E.	TIME .....	52
F.	COMPETITION .....	54
1.	General Observations .....	54
2.	Types of Vendors .....	56
G.	SAVINGS .....	56
H.	SUMMARY .....	57
V.	CONCLUSIONS AND RECOMMENDATIONS .....	61
A.	CONCLUSIONS .....	61
B.	ANSWERS TO RESEARCH QUESTIONS .....	63
1.	Primary Research Question .....	63
	<i>What is the best use of a reverse auction as an acquisition tool by United States Army contracting agencies? .....</i>	<i>63</i>
2.	Secondary Research Questions .....	64
a.	<i>What is a reverse auction? .....</i>	<i>64</i>
b.	<i>What is a good candidate for reverse auction? .....</i>	<i>64</i>
c.	<i>How is the opening bid price established? .....</i>	<i>65</i>
d.	<i>Does a reverse auction provide savings to the Government? .....</i>	<i>65</i>
e.	<i>What factors must be considered in determining whether a requirement is suitable for use of reverse auction techniques? .....</i>	<i>65</i>
f.	<i>Are there any statutory issues associated with executing a reverse auction? .....</i>	<i>65</i>
C.	RECOMMENDATIONS .....	66
1.	Establish a Users Guide to the Army's Reverse Auction .....	66
2.	Expand the Use of Reverse Auctions to Acquire Services .....	66

3.	Minimize Future Policies Regarding the Use of Reverse Auctions .....	66
D.	AREAS FOR FURTHER RESEARCH.....	67
1.	Future Reverse Auctions .....	67
2.	Reverse Auction Process Analysis .....	67
3.	Contractor Perspective.....	67
	LIST OF REFERENCES.....	69
	INITIAL DISTRIBUTION LIST .....	73

THIS PAGE INTENTIONALLY LEFT BLANK

## LIST OF FIGURES

Figure 2.1	Auction Comparison [From Ref. 14] .....	14
Figure 2.2	Supply versus Demand [From Ref. 21] .....	25
Figure 2.3	Pricing Hierarchy [From Ref. 4] .....	27
Figure 2.4	Dynamic Pricing Models [From Ref. 4] .....	28
Figure 3.1	CECOM Reverse Auction [After Ref. 23] .....	33
Figure 3.2	Fort Hood Reverse Auction [After Ref. 23] .....	38
Figure 3.3	TACOM Reverse Auction [After Ref. 27] .....	42
Figure 4.1	Item Categories .....	50
Figure 4.2	Competition Levels [Ref. 17] .....	55
Figure 4.3	Savings vs. Competition [Ref. 17] .....	55



THIS PAGE INTENTIONALLY LEFT BLANK

## LIST OF TABLES

Table 3.1	Total Reverse Auction [After Ref. 17] .....	45
Table 3.2	Extended Prices [After Ref. 17].....	46
Table 4.1	Total Savings [Ref. 17] .....	58

THIS PAGE INTENTIONALLY LEFT BLANK

## LIST OF ACRONYMS

ADPE	Automated Data Processing Equipment
ASFI	Army Single Face to Industry
BPA	Blanket Purchase Agreement
CBD	Commerce Business Daily
CCR	Central Contractor Registration
CECOM	United States Army Communications-Electronics Command
COTS	Commercial Off The Shelf
CPRG	Contract Pricing Reference Guides
CPU	Central Processing Unit
DOD	Department of Defense
EOQ	Economic Order Quantities
ERAPT	Electronic Reverse Auction Project Team
FAR	Federal Acquisition Regulation
FARA	Federal Acquisition Reform Act
FASA	Federal Acquisition Streamlining Act
FORSCOM	United States Army Forces Command
GB	Giga-Byte
GPRA	Government Performance and Results Act
GSA	General Services Administration
IBOP	Interagency Business Opportunities Page
IDIQ	Indefinite Delivery Indefinite Quantity

IFB	Invitation for Bids
IGE	Independent Government Estimate
LPTA	Lowest Priced Technically Acceptable
MB	Mega-Byte
MILSPEC	Military Specification
OFPP	Office of Federal Procurement Policy
PDU	Power Distribution Unit
RBA	Revolution in Business Affairs
SAT	Simplified Acquisition Threshold
SOW	Statement of Work
TACOM	United States Army Tank-automotive and Armaments Command

## **ACKNOWLEDGMENTS**

I would first like to acknowledge the patience and understanding of my wife Jodi, whose loving support has been greatly appreciated throughout the drafting of this Thesis.

I would also like to give my most sincere gratitude to Commander Cory Yoder and Dr. Lee Edwards. Both gentlemen provided exceptional guidance during the course of this Thesis and the classroom environment.

THIS PAGE INTENTIONALLY LEFT BLANK

# **I. INTRODUCTION**

## **A. PURPOSE**

The purpose of this thesis is to investigate the basic characteristics of a reverse auction as an alternative method of procurement for the Department of the Army. Auction technologies provide an immense potential for cost savings. Other benefits include reduced administrative time and effort, decreased cycle time, and improved customer satisfaction. Reverse auctions offer the Government the means to replicate a successful commercial practice that is becoming the accepted way of doing business. The thesis reviews performance of the Army's Reverse Auction pilot program in three buying cases and 43 other reverse auctions. The comparative analysis identifies commonalities for success and differences between past experiences with the reverse auction. The results are analyzed and a set of conclusions and recommendations are developed. The thesis concludes by providing expected benefits and best uses for future users of reverse auction strategies in order to leverage the power being brought about by the Internet revolution.

## **B. BACKGROUND**

Acquisition reform has attempted to change the procurement process over the past several years. Some believe the reform measures have been changes in policy or revisions of a paperwork process. The draw down of the acquisition workforce and financial constraints demand acquisition professionals conduct business in a smarter, more efficient manner. The technological capability today provides Internet platforms that allow the commercial marketplace to take advantage of electronic commerce. The Army has implemented a reverse auction program designed to capture many of the practices in use in the commercial industry. Foremost, dynamic pricing replaces fixed pricing models



observed in traditional procurement strategies. Reverse auctions represent a dynamic pricing environment.

A reverse auction is one type of numerous auction techniques. A reverse auction is the opposite of an auction. Multiple sellers compete for the business of a single buyer. This process causes the price to be driven down, versus upward in a traditional auction. The bidding continues until a pre-established bidding time expires. Ideally, the lowest bid is made prior to the bidding time expiring. At the conclusion of the bidding time a winner is selected for award.

Competition is a key aspect of a dynamic marketplace. Electronic commerce provides consumers with instant access to an unlimited marketplace [Ref. 1]. This large-scale marketplace brings to bear the true nature of a competitive market economy. Limitations of space and time are removed in this model because the bidder community is not limited to a small population. The technologies present today allow the bidding population to span the global community.

The reverse auction creates the potential for realized savings if the competition bids below the price established by the price analysis. Price analysis helps determine what price is fair and reasonable. Price analysis is of particular importance because it is directly related to the possible savings incurred by the procuring agency. The price analysis establishes the starting point for the opening bid. Theoretically, this price would be the maximum amount the agency would pay using traditional procurement methods. In essence, the dynamic pricing present in a reverse auction defines the savings realized.

## **C. RESEARCH QUESTIONS**

### **1. Primary Research Question**

What is the best use of a reverse auction as an acquisition tool by United States Army contracting agencies?

### **2. Secondary Research Questions**

- What is a reverse auction?
- What is a good candidate for reverse auction?
- How is the opening bid price established?
- Does a reverse auction provide savings to the Government?
- What factors must be considered in determining whether a requirement is suitable for use of reverse auction techniques?
- Are there any statutory issues associated with executing a reverse auction?

## **D. METHODOLOGY**

Research investigation included a literature search of books, magazine articles, CD-ROM systems, Government reports and regulations, Internet based materials and other library information resources. Data were collected via interviews, lessons learned reports, and spreadsheets. Interviews were conducted with contracting officials in buying agencies that support the United States Army and personnel responsible for developing the reverse auction capability through the United States Army Communications-Electronics Command (CECOM) and the Army Single Face to Industry (ASFI). Interviews were conducted over the phone and through electronic mail exchanges.

## **E. SCOPE AND ORGANIZATION**

This thesis focuses on reviewing the reverse auction concept and its application in an electronic environment initiated by CECOM's pilot program. Three Army procurement agencies and their application of the technology provide the basis for data collection. Limited data from 43 reverse auctions, including the three cases, conducted

since May 2000 also provides insight. The analysis of the 43 acquisitions is used to validate findings and conclusions. The thesis does not review the specific technology used by the Army's pilot program or the capabilities beyond on-line reverse auction.

Chapter II: Background follows the introduction and provides background information for the following chapters. It reviews electronic commerce and reverse auction history, CECOM's initiative for the Army, competition, and price analysis techniques.

Chapter III: Data Summary presents facts from three acquisitions in the form of mini-case narratives. Most of the data are in the form of interviews. A limited summary of critical metrics of 43 reverse auctions conducted through the ASFI is presented in tabular form. All of the acquisitions were accomplished using the initiative started by CECOM in the form of an on-line reverse auction strategy. The acquisitions provide insight to the use of reverse auction technology in a Government agency.

Chapter IV: Analysis examines the data and indicates their implications. Deductive reasoning is employed in this interpretive chapter. Actual performances using a reverse auction strategy are compared to indicate a relationship. The comparative analysis results in common threads of successful execution.

Chapter V: Conclusions and Recommendations draws the thesis together and presents logical conclusions. They are interpretations of the facts presented. Chapter V offers recommendations for future use of on-line reverse auctions and the expected benefits of the strategy.

## **F. EXPECTED BENEFITS OF THIS THESIS**

This thesis is intended to primarily benefit the United States Army acquisition community. Other Government agencies interested in the benefits of reverse auction strategies will benefit from the research as well. The critical review and analysis of the program will result in recommendations that will allow the acquisition professionals serving the Army to maximize the benefits of the program while recognizing the limitations of the program.

THIS PAGE INTENTIONALLY LEFT BLANK

## **II. BACKGROUND**

### **A. INTRODUCTION**

This chapter provides a brief insight to acquisition reform and one innovative process derived from the commercial industry called on-line reverse auctioning. A discussion is presented that describes auctions and the many different formats. The thrust of this research is the reverse auction and the Army's application of the model. The implementation of auction techniques marks a transformation from a static pricing environment to a dynamic one. Dynamic pricing adds a new consideration to the Government pricing environment.

### **B. BACKGROUND**

After the conflict in the Gulf, the Department of Defense (DOD) became the "billpayer" for striking budget reductions. Reductions affected the overall force structure numbers, military and civilian, as well as the defense budget. At the same time the Acquisition Reform initiative started gaining momentum. The 1994 Federal Acquisition Streamlining Act (FASA) and the 1996 Federal Acquisition Reform Act (FARA) made significant changes to the way Government does business. In the process of becoming better stewards of public funds, the acquisition community became innovative in its efforts to deal with a decreasing budget and resources. The Revolution in Business Affairs (RBA) is an effort by DOD to take advantage of the technology and management lessons found in world-class commercial companies that have maintained the U.S. leadership position in world commerce [Ref. 2].

Acquisition leaders actually put challenges before the community to innovate the acquisition processes. Everyone has heard the comment to do more with less. Less in

today's era means fewer resources – financial and personnel. The commercial sector provides great access to emerging technologies and processes. The removal of statutory impediments and the ability to try new methods empowers the acquisition professionals to execute their missions in a new environment.

In a statement before the Subcommittee on Government Management, Information and Technology, the former administrator for Federal Procurement Policy, Diedre A. Lee made the following statement.

We must continue to look ahead –staying alert to changing commercial practices and conditions and new technologies – to identify additional reforms with substantial potential benefits. [Ref. 3]

Clearly policy makers understand the importance of change. Highly successful corporations focus the workforce on key initiatives. Turning to the commercial sector can assist the Government in using new contracting tools to obtain up-to-date technology and better prices. [Ref. 3]

Ms. Lee further highlighted the opportunities offered through electronic commerce. Electronic commerce will potentially redesign the buying process. In strategic terms, agencies must take aggressive action to capitalize on the commercial developments in electronic commerce technologies. The opportunities offered must be evaluated for use prior to blanket adoption. Obviously, ones with the greatest potential should be taken advantage of.

The on-line reverse auction is a way for the acquisition community to adopt a successful practice from the commercial industry. On-line reverse auction capabilities are even more lucrative when you consider the Government is not the leader in this

technology and would benefit from the technological transfusion of the process from commercial entities. There are three potential applications of the auction model in the public sector: procurement activities; disposition of used/surplus/seized assets; and internal management [Ref. 4]. Of these proposed applications, procurement activities by buying agencies are the focus of this thesis. In this realm, pricing is transformed from a static model into a dynamic one. Dynamic pricing is a "sophisticated term for environments where prices are not fixed." [Ref. 5]

Procurement activities for goods and services by Government agencies has grown to over half a trillion dollars [Ref. 4]. The sheer numbers involved cause any cost reduction effort to be worthy of consideration. That is exactly what an on-line auction and dynamic pricing model attempt to accomplish. Agencies at all levels can benefit from the potential savings offered by the process.

Tied to this buying effort are the technology advances with web-based auction models. O'Malley refers to the Web as a giant bidding war [Ref. 6]. On-line auctions are becoming the mainstream model in the world of business [Ref. 4]. The foundation is laid for the auction model to advance in today's time. Technologies such as the computer, Internet, and web-based applications are the catalysts for innovation in the procurement arena.

In essence, the on-line reverse auction demonstrates the potential for cost and time savings. The efforts in the commercial industry with this technology deem it worthy of consideration in today's reform environment. Innovative processes such as on-line reverse auctions have the potential for orders of magnitude differences.



## **C. AUCTIONS**

### **1. History**

The Webster's defines auction as "... sale in which property or items of merchandise are sold to the highest bidder" [Ref. 7] The etymology of the term is Latin, from *augere*, meaning to increase. Today, the increase refers to the escalating price offered for a good or service.

Auctions date back to 500 B.C. The exact date and time of the first auctions are not exactly known. However, historians agree they have been in existence for quite some time. Fifth century Greeks auctioned mature women for marriage, but the Romans are believed to be the first to sell goods at an auction [Ref. 8]. Auctions transitioned through the 1600s as mechanisms to sell books and arts by the British to means of raising funds to pay taxes and debts by early Americans in the 1700s. The 1800s introduced the slave market in the Western world to the auction arena. The Civil War provided the environment for auctions to be used as a means to sell seized property. Auctions remained in this type of use through the 1800s and into the first half of the 1900s [Ref. 9].

At the conclusion of World War II, businessmen seized an opportunity to develop the auction in a marketing manner. Private auctions stimulated the post war era. Goods and real estate auctions linked to banks, attorneys, accountants, court systems, Government agencies, and the public raised the reputation of auctions from its earlier marred status. [Ref. 9]

A detractor to the previous auction model was the cost of time. To gain the advantage of dynamic pricing models the buyers and sellers had to be present in the same place and time. The advent of the Internet and the on-line auction mitigates the

inefficiencies by bringing the buyers and sellers together in cyberspace [Ref. 10]. The new auction model is creating a commerce market on the global scale. The Internet analyst firm Keenan Vision believes consumer and business on-line auctions will account for almost 30 percent of all electronic commerce by 2002 [Ref. 4].

Through time the auction has served the environment in which it was used well. The business model brings together the buyer and seller in a real time market place where personal elasticities are taken into account immediately. The resulting dynamic pricing ensures the laws of supply and demand in our capitalist society determine the rate paid. This is a very powerful model made even more useful by technology today.

## **2. Types of Auctions**

There are six major forms of auction used in the off-line and on-line environments [Ref. 4]. The most predominant are the: 1) English auction; 2) Yankee auction; 3) Dutch auction; 4) Traditional sealed bid auction; 5) Vickrey auction; and 6) the Reverse auction. The English auction is synonymous with ascending price. Bidding begins at a low price and as bidders compete, the price is driven higher. Bidders compete anonymously until the bid price is no longer raised. In this auction there is only one item available.

The Yankee auction is a version of the English auction but multiple items are offered. The winners in the auction are ranked by their bids according to the highest bid price offered, the largest quantity bid, and then the earliest bid time. The Yankee auction offers participants the option of accepting a full or partial quantity. [Ref. 4]

The Dutch auction introduces a variation to the standard auction format. The auction begins at a high starting price at which no one is believed to bid at. The bid price is reduced until bids are received. [Ref. 4]

A Traditional sealed bid auction is most similar to an acquisition strategy designed around an Invitation for Bids (IFB). Bidders remain anonymous and the high bid for an item on sale is the winner. If the item is for purchase, the low bid would win. [Ref. 4]

The Vickrey auction provides for more strategy. In this auction the winner is the one who bids the highest bid. The winner only pays the amount bid by the next highest offer. The winner does not have to pay what he thought an item was worth, simply what the next person thought. This model may actually provide the most accurate market price for an item because it mitigates the “winner’s curse.” The “winner’s curse” is defined as what people suffer when they “win” an auction by overestimating how much something is worth, therefore bidding too much. [Ref. 11]

The Reverse auction is designed for a buyer. The buyer establishes the auction around a requirement. Suppliers bid anonymously to win the award and fill the requirement. Bidders submit bids in a descending price process. The winner is the one that submits the lowest bid.

In the modern era a new term associated with auctions has come to the forefront. The Web auction is part of a dynamic commerce strategy that allows buyers and sellers to determine prices in real time on a per-transaction basis [Ref. 12]. A web auction strategy allows a company to optimize pricing and customer interactions. In this environment, prices vary in real time based on the current state of supply and demand. The Web auction incorporates customer price sensitivity into the model in an effort to create a more efficient market place. This environment affords a great opportunity. According to Hal Varian, “The Internet is the greatest medium in the history of economics for testing

all manner of hypotheses about which auctions work best under what circumstances.”

[Ref. 13]

Lastly, the term private auction needs to be clarified. A private auction is one in which only a specific group of bidders or suppliers are allowed to compete. The privacy aspect allows the user to define exactly who will participate, or not participate.

### **3. Reverse Auctions**

What is a reverse auction? The simple answer is that it is the opposite of a more traditional auction. The traditional auction model involves a seller offering a good for sale and buyers competing with each other for the purchase. The price is bid higher by each successive offer until no one is willing to bid a higher price. In a reverse auction one buyer is offering his purchase for numerous sellers to bid for his patronage. The sellers successively bid the price down. Reverse auctions typically run for a pre-determined amount of time or until no one bids a lower price. Priceline.com is an example of a reverse auction. Reverse auction has been referred to as “unsealed bidding” and a lively price battle.

Figure 2.1, derived from a graphic created by Denis Orsinger for Acquisition Solutions, portrays the differences between traditional auctions and reverse auctions.

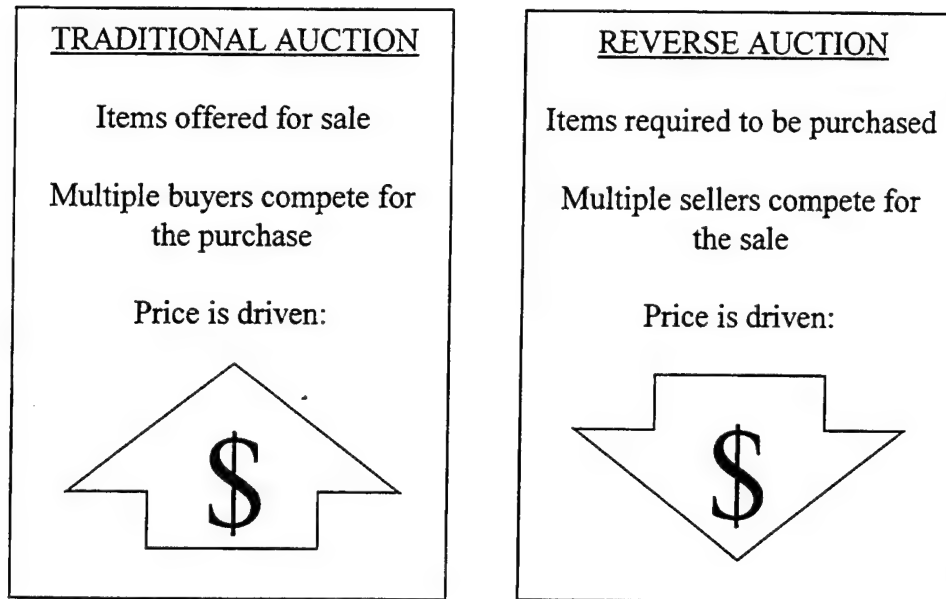


Figure 2.1 Auction Comparison [From Ref. 14]

The reverse auction process is rather simple in nature and description. Most organizations conducting reverse auctions pre-screen the suppliers. The process may require large up front costs and the buyer is keen to receiving high quality products. Therefore, it is imperative to screen for established, responsible competitors [Ref. 14]. Pre-screening also allows organizations to restrict competition. Restricting the competition allows the buyer to limit the auction to sellers such as small business. Obviously, the opposite end of the spectrum could include industry leaders.

Once sources are identified an on-line auction service conducts the process through a secure web site. Solicitations can be submitted electronically. Pre-registration ensures the sellers receive access to the site and training prior to the auction taking place. Sellers must agree to the terms of the auction prior to participation. Once the auction starts, bids are submitted anonymously. Alphanumeric characters are assigned to each vendor. On the auction site, only these characters appear. Thus, the vendor's true identity

remains unknown to other competitors. Bids can be submitted electronically directly to the site or via off-line vehicles such as a telephone line. The process does allow the contracting officer and other buying agency personnel to watch the auction from an independent workstation. At the conclusion of the predetermined time, the lowest bid is the winner.

#### **4. Legality Issues**

The 1997 Federal Acquisition Regulation (FAR) rewrite removed language prohibited auctioning [Ref. 15]. The FAR council actually changed the language that had been in place for over 30 years. Agencies still have concerns over the legality of the auctions. A major concern stems from the basic descriptive differences between on-line reverse auctions and more traditional methods of procurement. Traditional methods such as sealed bidding, two-step sealed bidding, and negotiations are static pricing models. Reverse auctions are dynamic and open price battles [Ref. 14].

The concern deals with the Government revealing bid information of one bidder to another bidder. The legal consensus is that the practice is an acceptable process mitigated by the fact vendors must give their approval for the competition to see their prices during the auction. Be reminded, the vendor's identity remains anonymous throughout the process. Cost data are neither shared nor visible.

The current thinking in the Office of Federal Procurement Policy (OFPP) is to eliminate any existing FAR impediments to reverse auctioning. At the Reverse Auctioning Conference in August 2000 the general consensus was that the process is so new that the current approach is the most appropriate at this point in time. No one wants to issue guidance that will constrain innovation in this arena.

## **D. ARMY REVERSE AUCTION**

### **1. Background**

In May 2000, the Deputy Assistance Secretary of the Army for Acquisition and Logistics (AL&T), Kenneth J. Oscar challenged Army contracting activities to run reverse auctioning pilot programs [Ref. 16]. In October 2000, David C. Wyld prepared a grant report for PricewaterhouseCoopers Endowment for the Business of Government. The Wyld report and Oscar's challenge served as the impetus for the Army's auction model initiative.

The program offers an opportunity to improve Government business practices. In an effort to expand its Interactive Business Opportunities Page (IBOP), the program represents the Communications-Electronics Command (CECOM) Acquisition Center's goal to make on-line acquisitions more efficient and cost effective. CECOM and its Electronic Reverse Auction Project Team (ERAPT) sought to reduce acquisition lead times in a "Best Value" decision rather than simply lowest priced products. As well, the program fulfills the mandate set forth in the Government Performance and Results Act (GPRA). This commercial industry practice has the potential to lower overall acquisition costs for services and supplies while maintaining a competitive environment. [Ref. 1]

CECOM, located at Fort Monmouth, New Jersey, answered Oscar's call. Shortly thereafter the command established the ERAPT. The team quickly established the process for an on-line reverse auction and conducted the Army's first such event on May 17, 2000. The entire Army readily adopted the CECOM approach. The program gained attention from the United States Air Force and the United States Marine Corps. Both have joined the Army in their approach to the on-line auctioning model. [Ref. 1] The

Department of State, the Department of Energy, and the Department of Agriculture have all shown interest in conducting on-line reverse auction demonstrations using the CECOM model. Just recently the United States Navy has inquired about the model.

CECOM's support contractor contracted with Frictionless Commerce, Inc. and Moai Technologies to tailor software applications to meet the specific needs of the new tool. However, Moai Technologies is no longer a partner in the arrangement. All software used comes from Frictionless Commerce Inc. The design is based around the Internet and web-based interfaces. This design allowed for integration into the Army Single Face to Industry (ASFI) website. The systems design also ensured instant interaction between the buyer and suppliers in an easy to use environment. Participants range from industry leaders to 8(a) businesses to both small and disadvantaged businesses. The AFSI website serves as a portal for the entire Army community to access and use the reverse auction function. The established contract includes a DOD wide license, which has allowed overseas units access to the model. Particularly important to savings potential, there are no transaction fees by a third party provider. [Ref. 17]

It is important to point out the tool developed by CECOM consists of four distinct components. The components include a "Spidering" tool, "Reverse Auction" tool, Forward Auction Tool "A", and a Forward Auction Tool "B." The reverse auction tool is the focus of this research. [Ref. 1]

## **2. Initial Demonstrations**

CECOM began the pilot program with two immediate demonstration auctions. The first was conducted on May 17, 2000 and was a buy for a Ricoh Secure Fax System. The initial bid price was set at \$6,891. The final bid and purchase price was \$5,511. The



\$1,380 decrease represented a savings of 20%. The second auction was for two IBM Thinkpad notebook computers (or equivalent). The initial bid price was established at \$7,000 each. The final price paid was \$3,280, or more than 50% savings [Ref. 18]. The initial trials showed great promise as an innovative process change [Ref. 1]. To date the CECOM on-line reverse auctioning tool has been used in 43 reverse auctions. Savings range from 0% to 53%. Total savings realized surpass \$1.6 million in just one year of demonstration.

Initial feedback from industry is promising. Comments refer to the ease in which the web site is navigable. Small and disadvantaged firms also give praise to the openness of the process. Some actually claim the process is fairer because of the openness. The openness obviates a perception that selecting an existing General Services Administration (GSA) schedule or other Government-wide contract vehicle is a “de facto” sole source acquisition by a requiring activity. The program provides suppliers with an easily acceptable source of business opportunities while maintaining a competitive environment while the Government obtains the best value for its customers. [Ref. 17]

### **3. Process**

On-line reverse auctioning is being referred to as an innovative change to the process of acquiring goods and services in the Government. Edward G. Elgart describes CECOM’s approach to on-line reverse auctioning in the following quote.

Reverse auctioning is a process whereby contracting officers enter specific product features, delivery dates, and warranties. Then a best value analysis is performed by weighing each feature’s importance. This information is then posted to our web site, known as the Army Single Face to Industry Interactive Business Opportunities Page, along with the starting and ending date for the reverse auction. The prospective sellers offer their best price and, as other sellers post their best prices, sellers are permitted to reduce their original price thus defining “Reverse Auctioning.” [Ref. 16]

The process begins with the identification of a need. The customer describes the need by specifying features or standards. Traditional acquisition strategies follow the same course. In the reverse auction strategy multiple avenues are available depending on the specific buy. In most cases vendors are screened prior to participation in the private auction. All vendors are registered in the Central Contractor Registration (CCR) database. CECOM has only used GSA vendors or its own contractors that already possess a Blanket Purchase Agreement (BPA) or Indefinite Delivery Indefinite Quantity (IDIQ) contract vehicle. In the instances where vendors are not screened prior to the auction or invited to participate, such as Sealed Bid procedures, the contracting officer conducts a pre-award survey upon completion of the auction but prior to award. This does not establish a competitive range because CECOM is allowing just about anyone to participate. Future enhancements to the model will allow for "Best Value" awards. [Ref. 17]

Solicitations occur in electronic and paper formats. The contracting officer has the discretion to determine the most appropriate medium. In Army buys thus far, the requirement has ranged from Military Specification (MILSPEC) items to Commercial Off The Shelf (COTS) items. However, no auctions for services have occurred. The date and time of the auction is publicized in order to allow ample time for vendors to register and receive training. Even though the model is web based and accessible from any computer with Internet access, minimum training is necessary for orientation to the interface semantics.

The contracting officer establishes initial bid prices. Price analysis techniques assist the contracting officer with this process. In essence, the opening bid price

represents what the Government deems a fair and reasonable price. The dynamics of the auctioning model occur when the auction begins.

The majority of reverse auctions conducted to date were designed for a 30-minute run time. However, latitude does exist to extend the auction based on bids received in the last minute. If a bid is received in the last five minutes, time is added to the run clock. Five-minute increments appear to be the norm. During the course of the auction vendors bid the price down based on their strategies for the competition. Any movement down on the price represents savings to the buying agency.

Vendors do remain anonymous. Prior to the auction vendors receive passwords and training. On the web page vendors only see alphanumeric identifiers that represent the other vendors. These identifications are only visible once a vendor makes a bid. Precautions such as these preclude any FAR violation because only the contracting officer knows the identity of each vendor.

Once the bidding ceases and time expires the auction is complete. At this point in time the contracting officer determines the award. Simplified acquisition procedures enhance the timeliness of award. However, at least seven of the auctions exceeded the Simplified Acquisition Threshold (SAT). In these cases award is more than a credit card transaction, but no more than traditional methods using fixed pricing techniques.

The main difference between the Army's on-line reverse auction and traditional methods is the dynamic pricing environment present in the auctioning model. In essence, all other aspects of the acquisition are similar with slight variations caused by the web-based interface.

#### **4. Future**

After one year of demonstration and use the future of the Army program looks promising. The program has gained notoriety and recognition as a leader in the industry. Prime contractors have asked to use the tools for their subcontracts. Other Government Departments have approached Army representatives in an effort to observe the process and develop programs within their own organizations. On 7 June 2001, the CECOM Acquisition Center was awarded the "Department of Defense Best Electronic Commerce Team Award for 2001." The award recognized the program's work with small business in developing and maintaining the Army's unified E-Market and Reverse Auction Project. *Government Executive* has recognized CECOM's Electronic Reverse Auctioning Project as an example of innovation and creative business strategy. The program has been selected as a winner in the "2001 Business Solutions in the Public Interest" as a member of an elite group that showcases the finest acquisition practitioners in the Federal Government. [Ref. 17]

### **E. PRICING ENVIRONMENT**

#### **1. Definition**

An important role of the contracting officer is to conduct price analysis to ensure the Government purchases supplies and services from responsible sources at a fair and reasonable price. Any study of the pricing environment should begin with defining price. Two definitions of price come to the forefront in Government purchasing. First, most people think of price as the amount of money that a buyer pays a seller for the delivery of a product or the performance of a service [Ref. 19]. Second, FAR 15.401 defines price as cost plus any fee or profit applicable to the contract type [Ref. 20]. The emphasis here is on cost and fee or profit. Combining the two definitions results in price defined as the

amount the buyer pays for a product or service, with the understanding if the price does not cover expenses, a loss will occur [Ref. 19].

## **2. Strategies**

An aspect of the pricing environment is the pricing strategies a seller may use. Basically, there are two approaches a seller may employ. First are cost-based pricing strategies that involve the analysis of the cost to produce a product and the addition of profit in determining the price. These strategies involve three techniques referred to as mark-up pricing, margin on direct cost, and rate-of-return pricing. The second category is market-based strategies that accomplish marketing objectives based on market conditions. These strategies consider the four “P”s of marketing: 1) price; 2) product; 3) place; 4) promotion. The techniques include profit-maximization pricing, market-share pricing, market skimming, current-revenue pricing, promotional pricing, demand-differential pricing, and market-competition pricing. [Ref. 19]

Strategies are important to understand because they provide insight to the industry in which a buyer is engaging. Knowledge of a seller’s motivation allows the buyer to customize his or her own purchasing strategy. Not all approaches work in every situation. Chapter IV provides more insight to the use of these strategies.

The Contract Pricing Reference Guides (CPRG) provide further explanations of the strategies and techniques. Cost-based pricing is the establishment of prices based on estimated direct costs or total cost plus a percentage mark-up. This is a common technique in an industry where customers are expected to negotiate the price paid. The automobile industry uses cost-based pricing. [Ref. 19]

Margin pricing is similar to cost-based pricing except the model uses cost to establish a price that will result in a pre-established profit margin measured as a percentage of price. [Ref. 19]

Rate-of-return pricing encourages the seller to calculate profit based on the financial investment required to provide the product, the return needed, and estimated sales volume. The calculated sales price includes the estimated price and desired profit. [Ref. 19]

Profit-maximization pricing closely resembles the market economy. The seller assumes that demand will fall as prices increase and demand will grow as prices decrease. It is important for sellers using this technique to understand it is the least effective when competitors react rapidly to price changes. [Ref. 19]

Market-share pricing is a technique used when prices are set low, even to the point of incurring a loss, in order to attract customers. As volume increases the losses eventually turn into long-term profits. In the business of major defense weapon systems a firm using this technique would be referred to as buying in. [Ref. 19]

Market skimming is simply an approach to capture maximum profits on a low volume of sales. The seller demands a high price and sells to those buyers willing to pay the higher price. The perception here is that the buyer is buying the best product. The perceived best product may not always be the best value. [Ref. 19]

Sellers more concerned about short-term business use current-revenue pricing. Financial despair may cause the seller to price in order to earn a smaller profit today

versus larger profits in the mid to long-term view. Market uncertainty as well as business financial instability are motivators for this type of pricing technique. [Ref. 19]

Promotional pricing results in products being priced to encourage the sales of a product line. Individual profits are not as important as the overall product line profit. Bait-and-switch pricing, loss leader, and prestige pricing arrangements are types of promotional pricing. [Ref. 19]

Demand-differential pricing is when the sellers demands different prices for the same goods simply based on differing market segments. The utilities companies are prime examples of this type of pricing. They charge a lower rate for electricity during off peak hours. [Ref. 19]

Sellers often find themselves pricing products based on what the competition is doing or is expected to do. This method is Market-competition pricing. The gas price wars are examples of how the competition can affect a seller's pricing technique. [Ref. 19]

### **3. Government Pricing Objective**

The primary pricing objective for Government purchases is to acquire supplies and services from responsible sources at fair and reasonable prices. In this context fair means fair to the buyer and seller. For the buyer, "fair" means fair market value or the cost incurred by a well-managed, responsible firm using reasonably efficient and economical methods of performance. "Fair" to the seller means the price is realistic in the sense the seller can perform and deliver under the terms and conditions of the contract.

Market conditions influence the determination of reasonableness. A generic explanation of a reasonable price includes a price that a prudent and competent buyer

would be willing to pay. Conditions in the market make that determination a moving target. What is reasonable today may not be tomorrow. The law of demand drives much of the price determination. When the price goes up, the quantity demanded goes down [Ref. 21]. Conversely, the law of supply states that when the price goes up, the quantity supplied goes up [Ref. 21].

In the middle supply and demand curves intersect and form the point of equilibrium. Depending on the market, the equilibrium changes constantly. The economic conditions, boom, recession, and depression affect available production capacity and thus establish the equilibrium point between supply and demand. This point changes, just as the reasonableness of a price changes. Figure 2.2 graphically presents this balance.

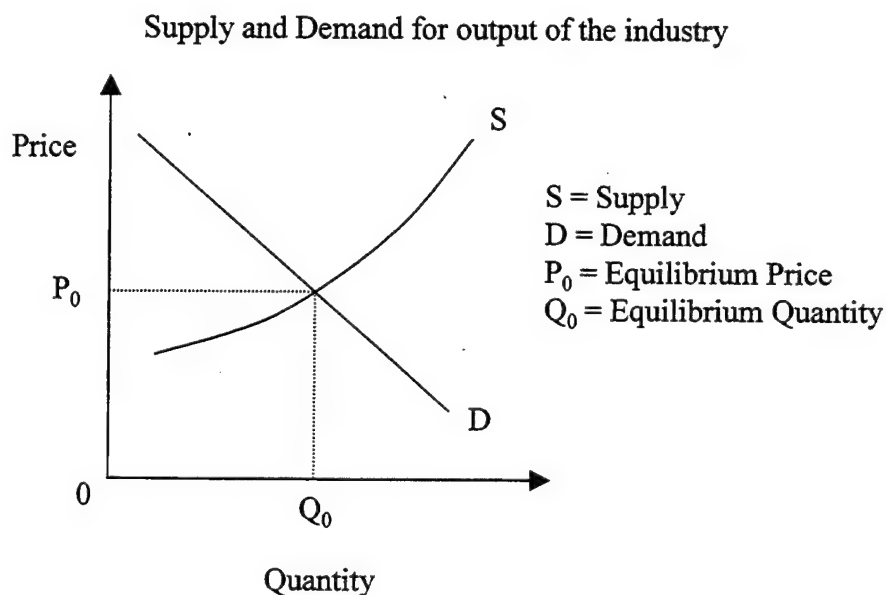


Figure 2.2 Supply versus Demand [From Ref. 21]

The one factor that ensures the forces of supply and demand work is competition. When there is competition in the marketplace, the market sets the quantity demanded and



supplied. Price is simply a product of the laws of supply and demand. In competitive equilibrium, the industry automatically produces at the lowest possible total cost. [Ref Landsburg] The reverse auction process promotes competition. Ina Merson actually says it promotes the Cardinal Rule of Government procurement: Thou shall seek competition. [Ref Merson]

#### **4. Price Analysis**

A tool used to determine if a price is fair and reasonable is the price analysis. The actual definition according to the FAR is the process of examining and evaluating a proposed price to determine if it is fair and reasonable, without evaluating its separate cost elements and proposed profit. Price analysis always involves some form of comparison.

The CPRG also lists bases for comparison:

- Proposed prices received in response to a solicitation
- Commercial prices
- Previously proposed prices
- Parametric estimates
- Independent Government estimates
- Prices obtained through market research

#### **5. Dynamic Pricing**

Up to now the discussion has oriented on static pricing models. Static models determine prices at a slower pace. Imagine a catalog with prices. Those prices were established under different conditions than the present market displays. Prices given are fixed or nearly inflexible. The auction model delivers a dynamic pricing model.

Dynamic pricing in the sense of auctions refers to an environment where prices are flexible. These environments put the power to set prices in the hands of the buyer. These models show the price markups have typically been in the 20% range versus traditional sales markups of 50% to 70% [Ref. 4]. This concept marks a change in the industry. The change is a shift in power from the marketing and sales departments to the buyer. From the buyers perspective there is a hierarchy in pricing. The following figure is adapted from OpenSite Technologies.

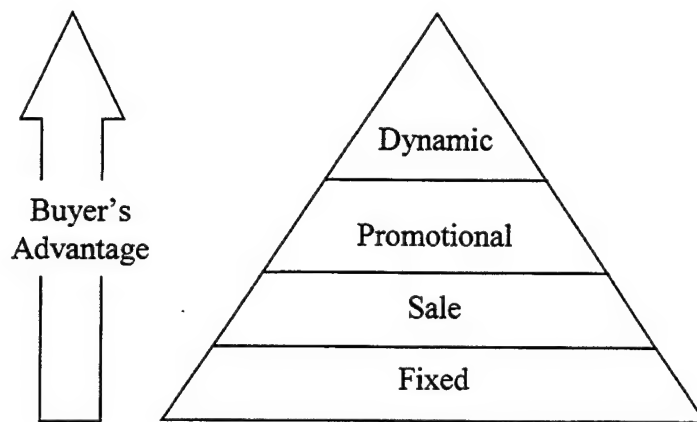


Figure 2.3 Pricing Hierarchy [From Ref. 4]

On-line auctions provide an environment for dynamic pricing models to flourish. Depending on the market conditions there are four types of dynamic pricing models most prevalent in the on-line auction community today. The following figure portrays the models and highlights the differences between the number of buyers and sellers.

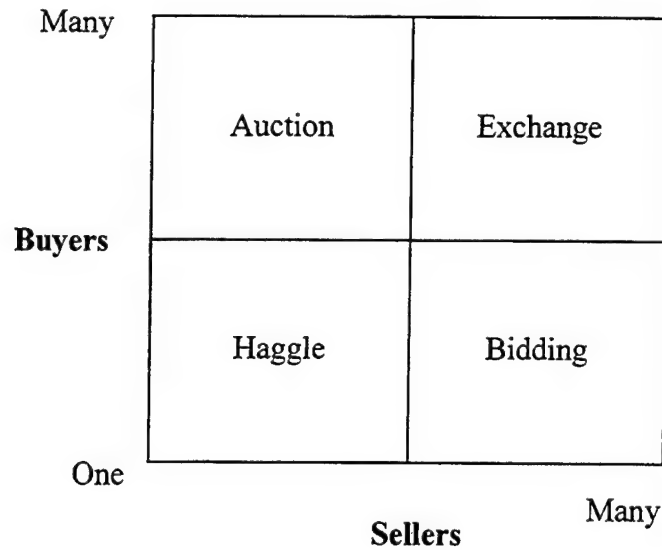


Figure 2.4 Dynamic Pricing Models [From Ref. 4]

The auction exhibits one seller and many buyers. In the haggle one buyer and seller bargain, or negotiate, to establish the price. Many buyers and sellers negotiate the price in the exchange. A reverse auction is an example of the bidding process where a buyer interacts with numerous sellers varying their prices. [Ref. 4]

The basis for dynamic pricing is the price elasticity of demand [Ref. 4]. Price elasticity of demand for a good measures how sensitively the buyer's consumption of a good responds to a change in price [Ref. 21]. In this type of environment items can be priced at what the current, instantaneous market will bear.

## F. SUMMARY

Acquisition Reform is an enabler for process innovation. Coupled with statutory rewrites and a desire and requirement to improve, on-line auctioning models demonstrate the possibility to realize cost savings and reduce administrative burdens in the acquisition community. Chapter II provided background information concerning auctions, legal

issues associated with auctions, a description of the Army's initiative, and insight to Government pricing techniques and strategies. Chapter III represents a transition to presenting data from actual on-line reverse auction purchases.

THIS PAGE INTENTIONALLY LEFT BLANK

### **III. DATA SUMMARY**

#### **A. INTRODUCTION**

This chapter presents data collected from periodicals and interviews with acquisition professionals that have been involved with the pilot program over the past year. The on-line reverse auction process is still evolving and this chapter presents a snapshot of insights from the users. In order to create a pattern in the presentation, each of the three cases follows a repetitive format. The discussion includes: a description of the items acquired; the quantities involved in the acquisition; initial and final bid prices; factors associated with time; and the number of vendors participating. The last piece of data presented is a table of all reverse auctions conducted through the ASFI. A common factor in each of the three cases is the choice to use a private reverse auction, where competitors require passwords to gain access to the bidding arena. This feature allows the contracting officer to ensure only responsible and responsive bidders participate.

#### **B. CASE 1**

CECOM conducted a reverse auction as a test case. They chose to use a spare parts replenishment item with a historical background of acquisition as its candidate. The reverse auction was conducted on July 25, 2000. This was one of the earliest auctions conducted through the CECOM initiative. Many of the procedures established over time benefited from this event. One of the prominent lessons learned centered around the auction time span and termination procedures.

##### **1. Description**

The item acquired was an electrical connector plug, NSN 5935-01-236-3117. The plug is part of a power control cable for a 30 Kw/400 Hz generator Power Distribution

Unit (PDU). The PDU is a component of the Patriot system. The item is designed to a military specification (MILSPEC). A complete drawing package existed and dictated the design of the item. This was a standard design and low risk item to procure. The MILSPEC design did not limit competition in the past or in this acquisition. The acquisition was determined to be a Lowest Priced Technically Acceptable (LPTA) action. [Ref. 22]

## **2. Quantity**

The acquisition was in response to a replenishment need. The number was set at 100 units. The acquisition history included three previous buys. Pins were acquired in 1991, 1998, and 1999 in quantities of 406, 30, and 60 respectively. Nothing led the researcher to believe the quantities were dictated by anything other than demand for stockage levels. Obviously, demand for replenishment was much higher in the time period surrounding Operations Desert Shield and Storm when Patriot systems were in high demand. [Ref. 22]

## **3. Opening/Final Bid Price**

Prices previously paid for this item were used by the Government to estimate a fair and reasonable price. The Government estimate was used to establish an opening bid price of \$1,180 per unit. The estimate for the total acquisition was \$118,000 ( $\$1,180 \times 100$ ). The final bid offered was \$780. Because this was a LPTA designed acquisition, the lowest bidder received the award. The total acquisition cost \$78,000 ( $\$780 \times 100$ ).

## **4. Time Period for Auction**

Figure 3.1 is a graphical representation of the bidding process during the reverse auction. Unfortunately, the bid history was not available for this auction. This was one of the earliest reverse auctions conducted through the CECOM site. One lesson learned was

to capture the bidding history data for future use. The auction commenced at 1:30 PM and was designed to last 30 minutes. Ten five-minute extensions were enacted because bids were received in the last five minutes. [Ref. 23]

The researcher has attempted to portray the bid history graphically with the use of only the opening and final bids. The graph indicates the reduction in price by the downward sloping line over a period of 80 minutes with a decrease in price from \$1180 to \$780 (\$-400) during the period.

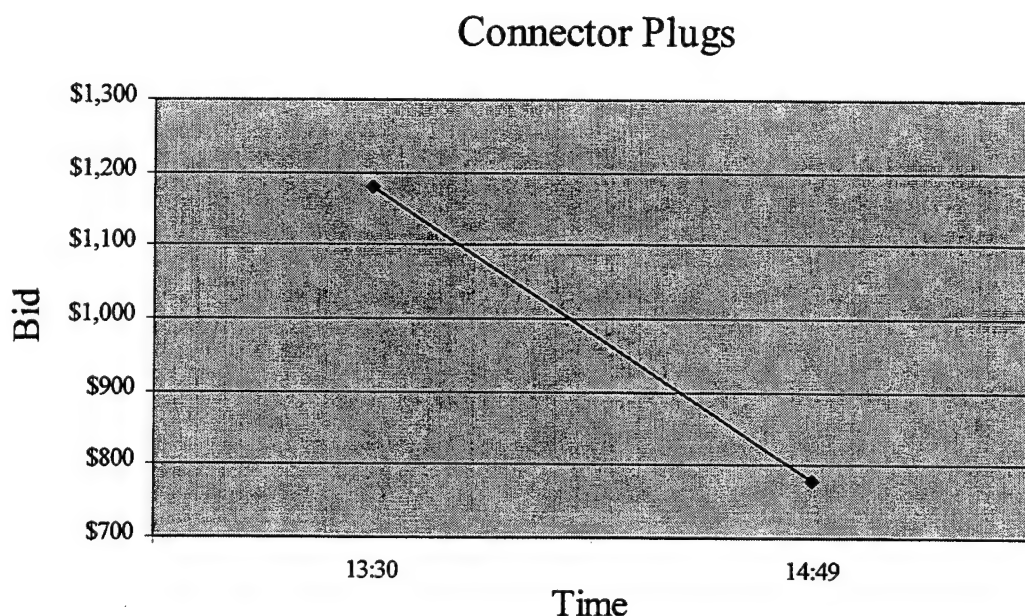


Figure 3.1 CECOM Reverse Auction [After Ref. 23]

## 5. Vendors

Two competitors participated in this reverse auction. Efforts to ensure competition followed the route of traditional sealed bid techniques. The solicitation was announced in the Commerce Business Daily (CBD) and on the CECOM IBOP. The



success in the past with acquiring this item eased any concerns with competition. However, the use of technology was new to the vendors and required training prior to the auction. On-line reverse auctioning was very new a year ago and few vendors were familiar with it.

## **6. Time Issues**

As one of the earliest tests of the Army's reverse auction initiative, training was imperative to success. In essence, the procedure mirrored traditional sealed bid techniques. Two factors stand out as contrasts though. First, there was a learning curve for the vendors. Because it was a new process, the vendors had to be reminded to sign up for passwords. As the process becomes more commonplace the need for reminders and training will decrease. A second issue involved the process of submitting bids. This reverse auction was designed to last for 30-minutes. One vendor submitted a bid so close to the end time it was not processed through the Internet and server in a timely manner. The vendor was not awarded the contract and submitted a protest based on the submission of his late bid. The protest was withdrawn before any action took place on the protest. There is an analogy between the delivery of a bid through the Internet and the delivery of a bid through the mail system. Ultimately, the bidder is responsible for the prompt delivery of his bid. [Ref. 22]

## **C. CASE 2**

The III Corps and Fort Hood, Texas Contracting Command conducted the second reverse auction analyzed in this thesis. The command supports III Corps and tenant units located at Fort Hood, Texas, Fort Bliss, Texas, Fort Carson, Colorado, and Fort Riley, Kansas. The command was the first United States Army Forces Command (FORSCOM) unit to attempt an on-line reverse auction. The initiative was directed in FORSCOM

guidance on the pilot program in response to the Deputy Assistant Secretary of the Army's request for FORSCOM to run a test before the year-end [Ref. 24].

# **1. Description**

On August 29, 2000 the III Corps Contracting Command conducted FORSCOM's first ever, on-line reverse auction [Ref. 25]. The local Aviation-Missile Command (AMCOM) OLR Project Team submitted a request for the command to procure 40 computer systems. The request identified the minimum characteristics as mid-tower, Pentium III 650 MHz Central Processing Units (CPU), or compatible, with 128 megabyte (MB) of Random Access Memory (RAM), 8-gigabyte (GB) hard drive, 16 MB video card, 250 MB Zip drive, keyboard, an optical mouse. The request also stipulated compatibility with on hand equipment such as disk drives, network interface cards, monitors and printers. No other special requirements were identified in the purchase request. The acquisition strategy centered on awarding based on the LPTA. [Ref. 26]

Market research conducted by the contracting office revealed the minimum stated requirements were below current technology standards. Several CPUs were identified which had faster processing speeds and larger hard drive storage capability. The risk for this acquisition was low because the item resembled a Commercial Off The Shelf (COTS) item and did not demand the latest technology advances. [Ref. 26]

Review of the above requirement by the contracting office revealed no reference to a quality standard such as warranty period or "Service after the Sale." Nor did the requirements stipulate a minimum industry standard such as Tier I or II manufacturing. These characteristics are commonly found in the commercial industry. Follow up communications with the user clarified this issue with the user. Based on the contract

specialist's recommendation to the user the requirements document was changed to include a 3-year warranty. The warranty accounted for 1<sup>st</sup> year on site parts and labor and 2<sup>nd</sup> and 3<sup>rd</sup> year parts and labor. As well, the salient characteristics of the system mandated manufacturing by a Tier I or II manufacturer. [Ref. 26]

## **2. Quantity**

The customer dictated the requirement for 40 systems in the purchase request. In an after action comment the contracting specialist noted the prospective contractors did not have a problem with the requirement. Market research led the buyers to believe larger quantities were more conducive to realizing greater production efficiencies and savings. The contracting command did not exercise influence in determining the number of units purchased because the customer only needed 40 units. [Ref. 26]

## **3. Opening/Final Bid Price**

The customer conducted market research in order to estimate a unit price. The market research focused on pricing separate components included in the CPU. In the computer industry this is a common practice. The component prices were added together to derive the cumulative price. The user added an additional 20% to account for assembly, shipping, and handling. The contracting specialist verified this price estimate by conducting a separate market research effort. The price estimate created by the user and verified by the contracting specialist was \$1500 per unit. The total estimated cost for the entire acquisition was \$60,000 (\$1,500 x 40). [Ref. 26]

Twelve bids were issued from three different companies during the course of the reverse auction. The final and accepted reverse auction bid was \$1340. The total

acquisition cost was \$53,600 ( $\$1,340 \times 40$ ). The lowest bidder was awarded the contract at the \$1,340 price.

#### **4. Time Period for Auction**

Thirty minutes was allotted for the reverse auction. The command thought 30 minutes was a sufficient amount of time for vendors to bid the price down to the lowest price and still sustain a fair profit. However, the reverse auction did allow for extensions. If a bid was submitted in the last five minutes of the auction, an additional five minutes of time was added to the auction commencing at the time of the bid. No rules established the end of the auction because extensions were granted past the 30-minute period. A period of five-minute inactivity since the last bid would terminate the auction if the total elapsed time exceeded 30 minutes. The rationale for this feature is to preclude the winner from being the last person to submit a bid versus the lowest bid available. Thirty minutes reverse auctions with five-minute extensions has turned into the standard allotment for on-line reverse auctions conducted through the CECOM ASFI.

In this case, two bids were received in the latter portion of the time frame and caused the auction to extend past the 30-minute period. The auction terminated after five minutes of inactivity after the last bid. This auction lasted a total of 32 minutes.

Figure 3.2 graphically displays the bid price over time. The downward sloping line indicates a lowering of the bid amount. The opening bid of \$1,500 is the first point plotted on the left hand side. The final bid is the last plot at \$1,340.

## Computer Systems

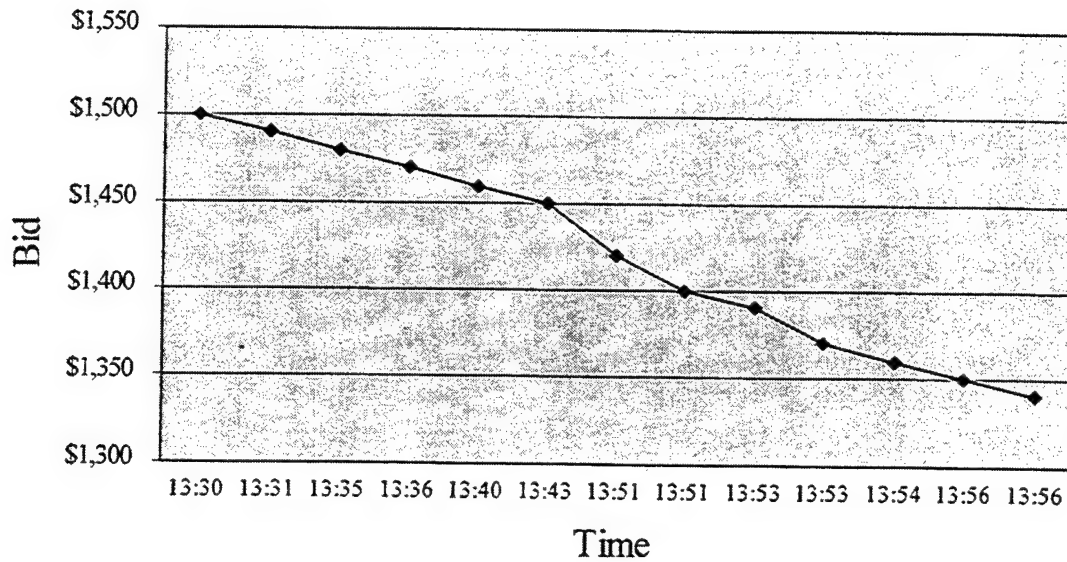


Figure 3.2 Fort Hood Reverse Auction [After Ref. 23]

### 5. Vendors

Five vendors were chosen among the existing GSA schedule that supplies computer equipment. The command chose to use this purchase as a small business set-aside. In order to keep the playing field level, all vendors chosen were classified as a small or small disadvantaged business. Initial contacts with the vendors were used to recruit participation in the on-line reverse auction process. One of the vendors did not respond to inquiries. A second vendor was interested in the process, but chose not to participate once the initial bid price was established because the price was below his lowest available price. Therefore, a total of three vendors participated in the competition. [Ref. 26]

## **6. Time Issues**

The requirement was received by the contracting command on 23 August 2000. The contracting office took six days preparing for the reverse auction. The majority of this time was used for market research and for communications with the customer. Upon completion of the reverse auction the contracting officer reviewed a specification sheet from the "winner" to ensure compliance with the stated requirements. In this case, the "winner" provided a product that exceeded the minimum salient requirements. Specifically, the CPU was rated at 733 Mhz and the hard drive capacity measured 15 GB. The contract was awarded on the same day of the reverse auction using DD Form 1155. Debriefings by the contracting officer occurred the day after the reverse auction. The remaining contractual actions were estimated to take five working days to complete. Twelve days were required to process and complete this acquisition. Using GSA vendors precluded CCR registration verification. [Ref. 26]

## **D. CASE 3**

The United States Army Tank-automotive and Armaments Command (TACOM) procures supplies in an effort to support the various programs under its purview. A common component such as brake pads requires acquisition at staggered intervals depending on inventory on-hand and demand. In December 2000, the TACOM chose to use the reverse auction initiative to fill a brake pad replenishment requirement.

### **1. Description**

The items being acquired were brake pads, NSN 2530-00-602-5738. These pads were acquired as replacement parts for use on tracked vehicles. The pads were completely described in a Military Technical Data Package categorized as complete by the TACOM Engineering Business Center. The data package fully defined the product

through specifications and drawings. The brake pads represent the opposite end of the description spectrum. [Ref. 27]

Demand for the brake pads began in 1982, the first year of acquisition for this specific supply. The acquisitions continued annually through 1986. The late 80's and 90's marked a period of no acquisitions for this item. After a 12-year hiatus the requirement surfaced again in 1998. Since then, the pads have been bought annually in reduced quantities. [Ref. 27]

## **2. Quantity**

The item manager established the quantity for acquisition. Replacement part orders are derived from inventory requirements and predicted usage. Quantities were dictated by the requirements determination process. Economic Order Quantities (EOQ) are always a potential factor, but they must be balanced against other factors such as holding costs. In this case, the buyer did not influence the quantity purchased, but simply responded to the customer's request. In 1999 the year's buy totaled 298. The acquisition in 2000 was for a quantity of 140. The reduction is over 50% from the previous year. [Ref. 27]

## **3. Opening/Final Bid Price**

Previous purchases for the same requirement provided a base for estimating prices. The item has not changed over time. The design is the same as earlier buys. The historical prices and the price paid in 1999 served as the basis for establishing the opening bid price of \$815. Review of the purchase did not indicate market research led to any revision of the price estimate. As well, personnel turnover in the office did not allow

further insight to the price analysis. The total estimated cost of the acquisition was \$111,300 ( $\$795 \times 140$ ).

During the course of a planned 30-minute reverse auction ten bids were submitted. At the conclusion of the event, and when no bidder chose to submit a lower bid, the final bid was established at \$700. The contract was awarded to the lowest bidder at the \$700 price. Total acquisition cost was \$98,000 ( $\$700 \times 140$ ).

#### **4. Time Period for Auction**

The auction was planned for 30-minutes. The terms of the auction included a provision for a five-minute extension if a bid was received in the last five minutes of the auction. As well, an inactive period of five minutes after the minimum auction period elapsed would terminate the auction. This process was previously described.

Figure 3.3 portrays the dynamic pricing as it occurred during the reverse auction. The maximum bid price of \$815 is the first point plotted on the left side of the graph. The final bid price of \$700 is the final plot. The figure graphically displays the lowering of the bid price over time.

#### **5. Vendors**

The contracting officer solicited four previous suppliers of the item based on their performance and standing. The first vendor was described as an "excellent" contractor. Problems were referenced in another, but waivers were in place and the contractor had produced before. The third vendor was technically good, but occasionally slow to deliver. The last vendor was simply described as good. All four vendors were classified as small businesses. Capability had been demonstrated before and the contracting officer thought



they were good candidates. It is important to remember GSA vendors were used in the process. [Ref. 28]

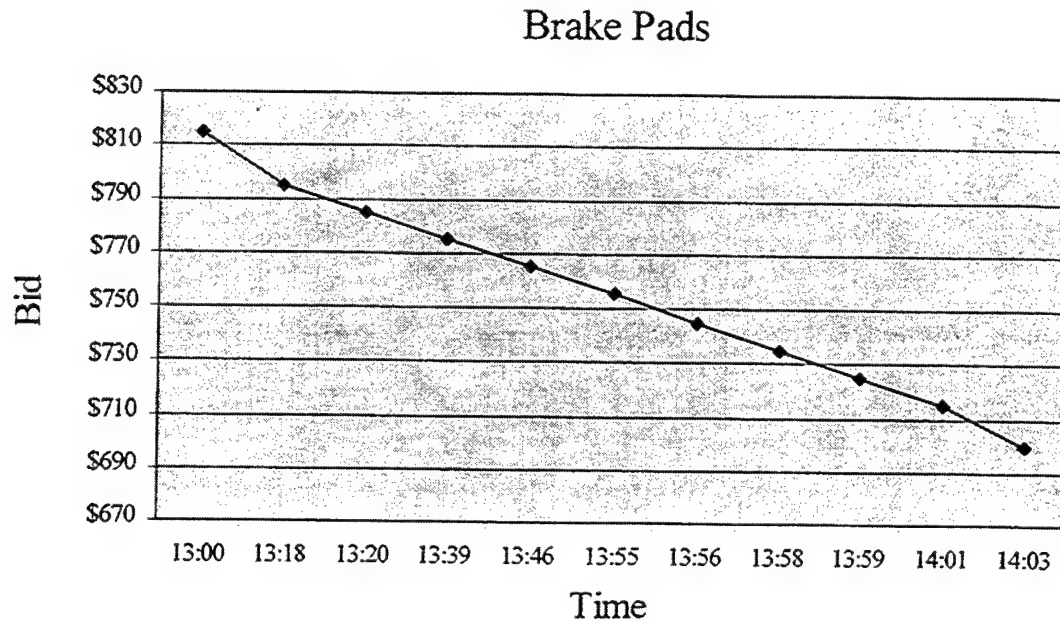


Figure 3.3 TACOM Reverse Auction [After Ref. 27]

Of the four, only three vendors chose to participate in the reverse auction on the day of the event. TACOM chose to use this acquisition as a set aside for award to a small business. Even though the item was built with a MILSPEC there was ample competition in the small business arena. In previous acquisitions for this item through sealed bid methods the competition surrounded around three to four competitors. The technology did not appear to cause concern for bidders.

## 6. Time Issues

No special process was created to notify the competitors of the solicitation. However, the buyer sent e-mail messages to all previous suppliers of the item and all

sources suggested by the TACOM Small Business Office to notify them of the on-line reverse auction. The purpose of the e-mail messages was to announce the solicitation appearance on TACOM's web page. Contracting personnel did not note any significant difference in time associated with the acquisition effort. The Indefinite Delivery/Indefinite Quantity (IDIQ) contract in place allows streamlining in the process after award. [Ref. 27]

One difference from the traditional sealed bid method employed in past buys was the need for training. The contracting officer ensured each vendor was in contact with the reverse auction administrator prior to the event for hands on training. The training resembled a reverse auction and allowed the vendors to practice making bids and get accustomed to the "buttonology."

#### **E. CONSOLIDATED REVERSE AUCTION DATA**

In just under one year CECOM's reverse auction initiative has served as the foundation for 43 on-line reverse auctions conducted by the United States Army, United States Air Force, and the United States Marine Corps. Table 3.1 presents pertinent data from these acquisitions. Acquisition users around the globe have experienced the web based reverse auction tool through the ASFI. The Internet has not only provided a seamless environment for the user community, but the suppliers as well.

Item descriptions range from common products such as livestock (goats) and lumber to sophisticated products like secure fax machines and computers. The range of products spans a spectrum of commodities from COTS to Military Specification (MILSPEC).

Quantities acquired range from single units to the hundreds. In some instances acquisitions were for lots. Lots should not be confused with single items because most lots totaled tens and hundreds of items. The size of the acquisition did not affect the ability to conduct a reverse auction process. However, Chapter IV will analyze the affect of small quantities on the success of achieving savings through the reverse auction process.

The number of vendors participating in any particular reverse auction ranges from one to nine. More competition causes the forces of the market economy to operate effectively. The on-line reverse auction environment serves as a dynamic environment based on real time changes in the market economy. Chapter IV will analyze this relationship examining the number of competitors and perceived success in achieving savings.

Finally, Table 3.1 presents opening bid prices and final bid prices for the 30 acquisitions. Data can be extrapolated to show the savings achieved measured against the price determined to be fair and reasonable prior to the reverse auction. Each action is surrounded in peculiarities specific to its case that are not presented in the table. However, over the course of 43 acquisitions trends and outcomes can be observed and measured.

Table 3.2 is similar to Table 3.1. However, the individual bid prices are extended for the total acquisition. In the cases of lots, the extended bid price is the same as the individual bid price. The extended bid prices portray the potential for order of magnitude differences using the reverse auction dynamic pricing model.

Product	Qty	Opening Bid	Award Bid	# Vendors
Secure Fax Machines	1	\$6,891	\$5,511	2
Laptops	2	\$7,000	\$3,280	3
Fax Machines	5	\$500	\$440	2
Electrical Connector Plugs	100	\$1,180	\$780	2
Computers 733 MHz	20	\$2,300	\$1,850	5
Computers 800 MHz	135	\$1,900	\$1,300	5
Computers 800 MHz	10	\$4,100	\$2,490	6
Computers	140	\$1,900	\$1,470	4
Computers	40	\$1,500	\$1,340	4
Computers 866 MHz	520	\$1,550	\$1,120	6
Photo Workshop	1	\$7,000	\$7,000	1
Color Printer	16	\$4,500	\$3,800	3
Computers	197	\$1,700	\$1,400	6
Lumber	1	\$17,000	\$15,400	3
Multipurpose Paper	1 Lot (880)	\$22,500	\$19,700	3
Overhead Projector	1	\$4,100	\$3,300	4
Goats	100	\$130	\$100	5
PC Card	1	\$12,200	\$7,600	5
Zip Drives	1 Lot (30)	\$4,950	\$3,900	3
Dishwashers	1 Lot (100)	\$22,000	\$15,700	8
Hot Water Heaters	1 Lot (100)	\$20,000	\$12,200	6
Brake Link	140	\$815	\$700	3
Tool Kits	100	\$900	\$895	5
Collar Assembly part	1 Lot (35)	\$145,425	\$121,500	7
Hydraulic Wrench	308	\$1,410	\$1,410	1
Office supplies	1 Lot (160)	\$10,000	\$6,000	9
Link Assembly part	1 Lot (54)	\$207,900	\$149,000	3
Supplemental Armor	87	\$490	\$442	3
Dishwashers, Ranges, Refrigerators	1 Lot (90)	\$31,000	\$23,300	3
Computer Hardware	1 Lot (278)	\$500,000	\$368,008	3
Desktop Computers	27	\$1,700	\$1,600	2
Grenade Launcher	1	\$11,500	\$10,990	3
DVD & Camcorder	1 Lot (2)	\$8,200	\$7,800	3
Notebook Computers	40	\$4,650	\$2,700	6
Hardware for Messaging System	1 Lot	\$230,000	\$138,850	3
Desktop Computers	1 Lot (60)	\$147,000	\$118,000	7
Appliances	1 Lot	\$42,000	\$33,600	3
Desktop Computers	1 Lot (109)	197,000	\$115,000	6
Paper	1 Lot (10)	\$43,000	\$37,328	8
Sun Equipment	1 Lot	\$1,847,000	\$1,717,500	9
Sun Microsystems	1 Lot	\$1,052,000	\$959,000	4
Eyepiece Assembly	1 Lot	\$550,000	\$261,500	2
Modular Office Buildings	1	\$24,000.00	\$17,400	3

Table 3.1 Total Reverse Auction [After Ref. 17]

Product	Qty	Extended Price Start	Extended Price Complete
Secure Fax Machines	1	\$6,891	\$5,511
Laptops	2	\$14,000	\$6,560
Fax Machines	5	\$2,500	\$2,200
Electrical Connector Plugs	100	\$118,000	\$78,000
Computers 733 MHz	20	\$46,000	\$37,000
Computers 800 MHz	135	\$256,500	\$175,500
Computers 800 MHz	10	\$41,000	\$24,900
Computers	140	\$266,000	\$205,800
Computers	40	\$60,000	\$53,600
Computers 866 MHz	520	\$806,000	\$582,400
Photo Workshop	1	\$7,000	\$7,000
Color Printer	16	\$72,000	\$60,800
Computers	197	\$334,900	\$275,800
Lumber	1	\$17,000	\$15,400
Multipurpose Paper	1 Lot (880)	\$22,500	\$19,700
Overhead Projector	1	\$4,100	\$3,300
Goats	100	\$13,000	\$10,000
PC Card	1	\$12,200	\$7,600
Zip Drives	1 Lot (30)	\$4,950	\$3,900
Dishwashers	1 Lot (100)	\$22,000	\$15,700
Hot Water Heaters	1 Lot (100)	\$20,000	\$12,200
Brake Link	140	\$114,100	\$98,000
Tool Kits	100	\$90,000	\$89,500
Collar Assembly part	1 Lot (35)	\$145,425	\$121,500
Hydraulic Wrench	308	\$434,280	\$434,280
Office supplies	1 Lot (160)	\$10,000	\$6,000
Link Assembly part	1 Lot (54)	\$207,900	\$149,000
Supplemental Armor	87	\$42,630	\$38,454
Dishwashers, Ranges, Refrigerators	1 Lot (90)	\$31,000	\$23,300
Computer Hardware	1 Lot (278)	\$500,000	\$368,008
Desktop Computers	27	\$45,900	\$43,200
Grenade Launcher	1	\$11,500	\$10,990
DVD & Camcorder	1 Lot (2)	\$8,200	\$7,800
Notebook Computers	40	\$186,000	\$108,000
Hardware for Messaging System	1 Lot	\$230,000	\$138,850
Desktop Computers	1 Lot (60)	\$147,000	\$118,000
Appliances	1 Lot	\$42,000	\$33,600
Desktop Computers	1 Lot (109)	\$197,000	\$115,000
Paper	1 Lot (10)	\$43,000	\$37,328
Sun Equipment	1 Lot	\$1,847,000	\$1,717,500
Sun Microsystems	1 Lot	\$1,052,000	\$959,000
Eyepiece Assembly	1 Lot	\$550,000	\$261,500
Modular Office Buildings	1	\$24,000	\$17,400

Table 3.2      Extended Prices [After Ref. 17]

## **F. SUMMARY**

This chapter presented three cases and a compilation of auctions to date in which contracting agencies used the Army's reverse auction initiative to acquire supplies. CECOM and TACOM acquired replenishment items manufactured to a MILSPEC while Fort Hood acquired commercial standard computers. The items acquired varied from generic to those with specific military functions. In all but two cases the maximum bid price was higher than the final bid price. The movement on the price indicates the potential for savings. Competition appears to be a driving factor in the reverse auction model. In each of the three cases presented, competition was present even though the auctions were limited to small businesses.

Credit must be given to the personnel making the choice to try new innovative techniques and make the process work better. Early attempts forged the way for progress because their lessons learned have benefited the process. Lessons learned pertaining to vendor recruitment and auction time periods have developed into standards within the process.

Chapter IV will constitute the analysis of the data presented in Chapter III. The trends between these data can serve as the basis for inferences about the effectiveness and usefulness of on-line reverse auctions in the future of acquisition.

THIS PAGE INTENTIONALLY LEFT BLANK

## **IV. ANALYSIS**

### **A. INTRODUCTION**

This chapter discusses the results of the research and the analysis of the data presented in the previous chapter. The focus for the analysis was two fold. The focus includes identifying common threads and trends in the data and actually measuring the savings incurred. After analyzing the data the researcher determined six areas existed which warranted discussion. The areas include: 1) Item Description; 2) Quantity; 3) Maximum Bid Determination; 4) Time; 5) Competition; and 6) Savings. Structuring the analysis around these topic areas provided a basis for discussion and means to compare performance.

### **B. ITEM DESCRIPTION**

The items acquired through the reverse auctions are characterized as Commercial Off The Shelf (COTS). Many of these items are definitively COTS because the industry, not the Government, determines the standards to which they are built and sold to the general public. However, some items are Military Specification (MILSPEC), built to a technical data package standard. Specifically, the brake shoe link and connector pin reverse auctions acquired items designed and built to a MILSPEC. It is important to point out that the items were previously acquired and the reverse auction did not represent an acquisition for a new requirement. At least seven of the items acquired are military unique, for a military requirement. In essence, the items acquired span the continuum from COTS to MILSPEC. This continuum not only accommodates the design character, but also the usability aspect of the item. While the items may be characterized as COTS,



the end use is also of a generic nature not necessarily military in nature. For instance, the computers acquired are most likely used in offices in the garrison environment.

A key characterization of the items acquired is that they were all goods. Services were not acquired in any of the auctions. The transition in the past few years to more than 50% of dollars spent for the acquisition of services makes this a prime target for future reverse auction uses.

The analysis appears to indicate there are four general categories of items acquired through the Army's reverse auction. These four categories are created from making inferences from generic item nomenclatures. The list includes:

- Military in nature
- Automated Data Processing Equipment (ADPE)
- Appliances
- Other

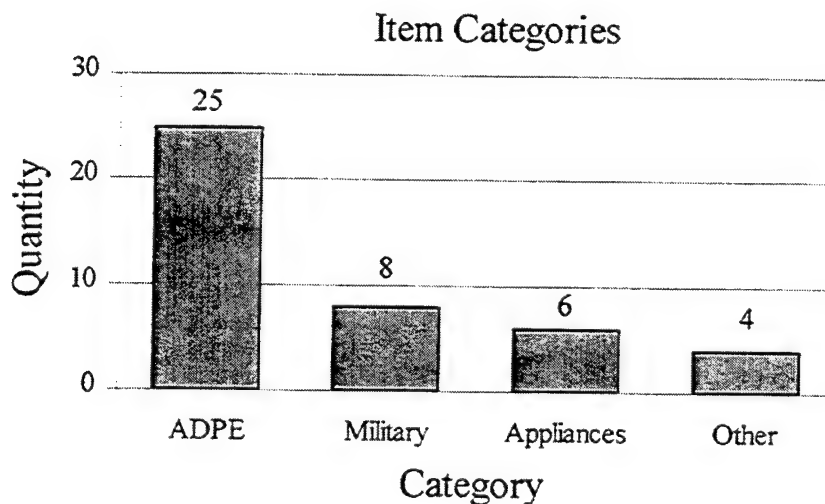


Figure 4.1 Item Categories

The military in nature category includes those items using a MILSPEC design or items whose end use is for a military end item not found in commercial use. This category includes items such as supplemental armor, the brake shoe, specific parts, the grenade launcher and such.

The second category is ADPE. These items are easy to identify. They include items such as laptop and desktop computers, fax machines, printers, overhead projectors, and other computer hardware.

The third category is appliances. Appliances include dishwashers, hot water heaters, ranges, and refrigerators.

The last category is a generic consolidation of items that do not clearly fit into one of the other categories. The list of items here includes lumber, buildings, animals, office supplies, and tool kits.

### **C. QUANTITY**

The quantity of items acquired using a reverse auction spans a spectrum of a single item to hundreds of items. The single item acquisitions were mostly demonstrations early in the pilot program. On the other end of the spectrum high quantity acquisitions accounted for the majority of buys. In one instance, 520 servers were acquired in one buy.

In the three cases reviewed, the quantities were determined by a single requirement. The data pertaining to the remaining reverse auctions do not provide any insight as to whether the quantities acquired were consolidated requirements or single requirements. Obviously, greater savings would be realized if requirements were combined.

Early in the program the actual number of items defined quantities. Towards the end of 2000 the quantities began to be listed as Lots of specific quantities. Overall, this has no bearing on the buy unless the auction stipulates all or none. None of the auctions conducted to date have split the acquisition between vendors. At least one contracting officer chose to structure the solicitation in a way to preserve the right to adjust quantities. In this instance, the quantity could fluctuate up or down by 20% but at the final reverse auction price [Ref. 29].

#### **D. MAXIMUM BID DETERMINATION**

In the three cases reviewed, each agency conducted an Independent Government Estimate (IGE) during the price analysis process. Two of the agencies used previous prices paid as the base for comparison. The third agency used a customer price analysis along with the contracting specialist's independent market research to compare prices.

In each case the price analysis determined a fair and reasonable price for the item. This is important because this price serves as the basis to measure dollar savings. This price is what the agency would have been willing to pay for the item. In two instances, the maximum bid was the final bid price offered. Price analysis is still an important step in the process because it determines the starting point for all bid decrements.

#### **E. TIME**

The personnel involved in all three cases reviewed referred to the reverse auction procedure as similar to a sealed bid process. Using GSA vendors reduced the timeline for acquisitions. The major differences between a traditional method and on-line reverse auctioning include time for vendor training and the dynamic period of price determination.

The researcher believes time necessary to recruit vendors and train vendors will eventually decrease. A year ago the process was too new and the experience level was low. In time, more vendors will become exposed to E-Commerce processes and the comfort level will increase.

However, it is hard to determine how much effort is required to ensure competition. One contracting specialist actually sent letters to vendors in order to recruit participation. This was one of the early acquisitions. It cannot be determined from the research conducted whether this much proactive support from the contracting agency is necessary at this time.

Thirty minutes with five-minute extensions has developed as the standard time allotted for a reverse auction. The five-minute extension is an adaptation that will prevent any last second bid submission game play. The intent for a time period is to allow all bidders the opportunity to participate in a timely manner. The extension ensures each bidder has the opportunity to assess the previous bid and determine whether or not they want to submit a new bid. This also represents the evolution of the reverse auction from an electronic bulletin board type media where bids were posted over the course of days to a compacted and dynamic period of time measured in minutes.

In each of the three cases reviewed there was no conclusive data captured that allowed analysis of time savings. General statements comparing the reverse auction process to a sealed bid method did not allow direct comparison of the effort required.

## **F. COMPETITION**

### **1. General Observations**

There is one rule that the data overwhelmingly enforces. Without competition there is little opportunity for monetary savings. In the two cases in which only one vendor participated in the reverse auction the final bid was the maximum bid determined prior to the reverse auction. The savings in those cases was \$0, resulting in no monetary savings.

In the other reverse auctions the number of vendors participating ranged from two to nine. The mean number of competitors is four. Figure 4.1 presents the level of competition in each reverse auction. The number of competitors is plotted against the auction number. There appears to be no direct relationship between the number of vendors participating and the amount of savings realized. Figure 4.2 is a scatter plot graph. The savings realized is on the vertical axis and the number of competitors is on the horizontal axis. The figure presents a range of savings at each different level of competition. The type of item, industry, and current market conditions appear to determine the amount of savings. This research did not allude to the type of pricing strategies used in the different industries. The underlying premise remains that the reverse auction is a dynamic pricing environment that acknowledges the current market conditions (supply vs. demand) when determining price.

A timely example of this occurred in May 2001 when Dell chose to price their computers on a market share strategy. The timing and dynamics of a reverse auction allowed buyers to realize savings based on the current market. The reverse auction appeared to have capitalized on economic trends at the time of the auction. [Ref. 30]

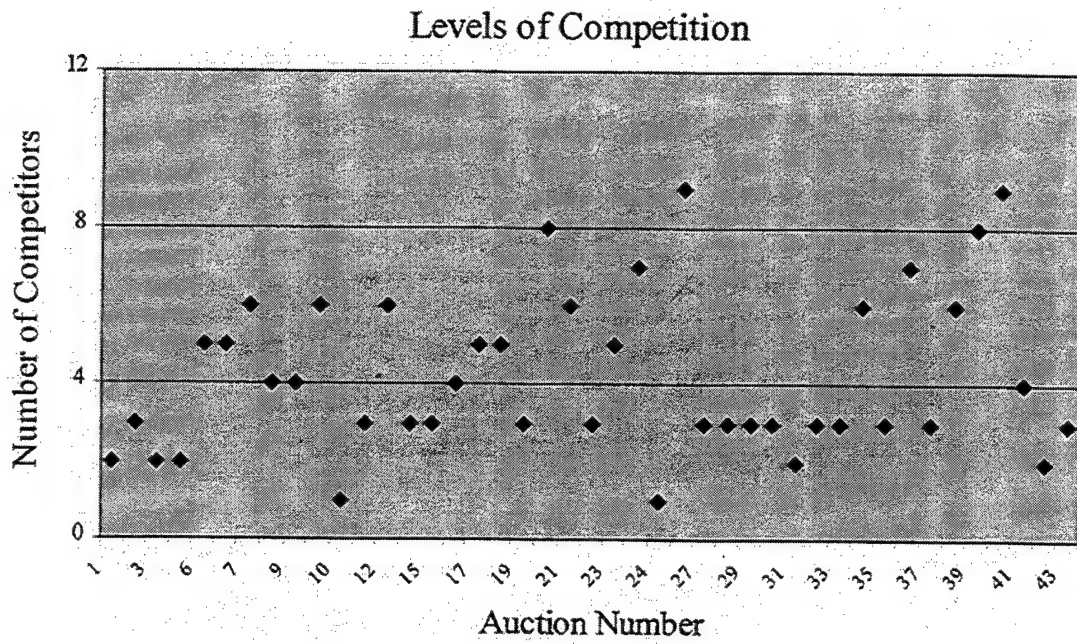


Figure 4.2 Competition Levels [Ref. 17]

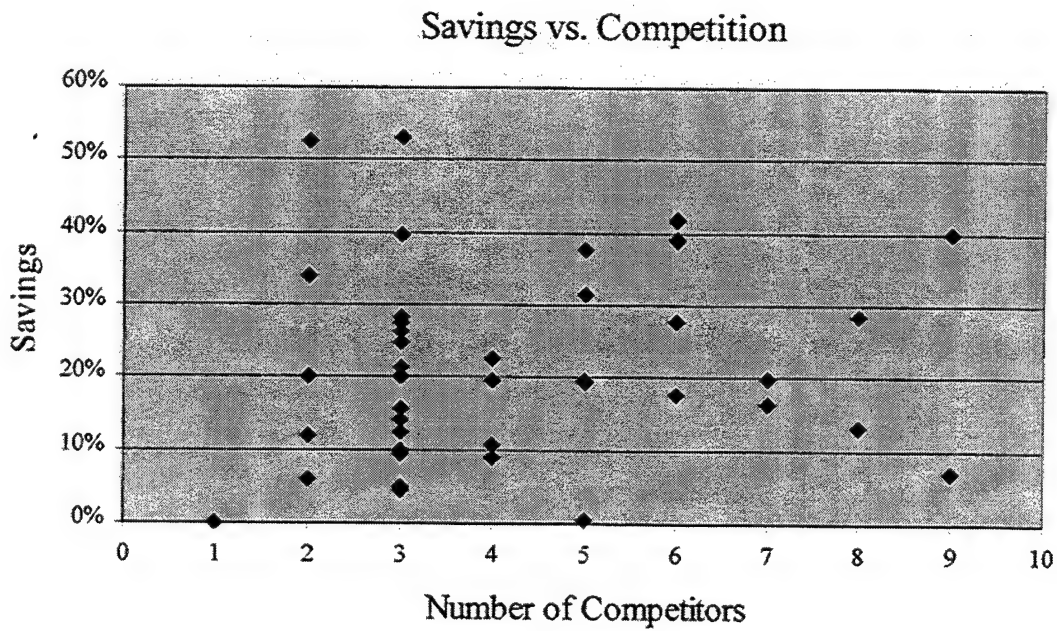


Figure 4.3 Savings vs. Competition [Ref. 17]

## **2. Types of Vendors**

In two of the cases reviewed the reverse auctions were limited to small business concerns. The contracting agency was able to establish the buy as a small business set-aside. Industry leaders such as Micron, Dell, and Gateway participated in other reverse auctions for computers. A spectrum exists that spans from the small business owner to the industry leaders. The reverse auction provides the flexibility for the contracting officer to meet different goals such as small business set-asides.

## **G. SAVINGS**

The true savings realized in using a reverse auction strategy is in the form of dollars returned to the command. The monetary savings is easy to compute using the maximum bid and the final (award) bid. The difference between the two is the savings realized for that particular acquisition. The underlying premise is that the customer would buy the item at the maximum bid price. This concept refers to the customer's utility for the item at a particular point in time. Utility "...measures how much pleasure or satisfaction..." is derived from owning a particular basket of goods [Ref. 21].

Table 4.1 is a compilation of all the reverse auctions conducted through the ASFI to date. The "Total Dollars Saved" column represents the difference between the maximum bid price and the final award bid price extended for the entire acquisition. The "% Saved" column is derived by dividing the total dollars saved by the extended maximum bid price for the acquisition. The auctions are arranged in order of savings realized, high to low.

High dollar acquisitions provide the opportunity for high dollar savings. The true power of the reverse auction would be realized if requirements were combined into single

auctions. The economies of scale would allow the vendors more ability to lower the price. The researcher was unable to conclude if requirements were combined. In the three cases reviewed it was known requirements were not combined. Obviously, specific buys may not lend themselves to larger numbers. Generic acquisitions, such as computers, provide greater opportunity for combining requirements.

The arithmetic mean of the reverse auction savings was 21.83%. The mean is simply the average savings of the 43 reverse auctions reviewed. Another way to analyze the savings is to measure the dollars saved. The total dollars saved for the reverse auctions totaled \$1,606,395. This value translates to an overall savings of 19.82%.

## **H. SUMMARY**

The most convincing data reviewed during the research stems from the savings realized by pursuing a reverse auction strategy. Without a doubt, in these acquisitions the reverse auction provided savings. What the data do not present is a comparison of prices paid through a reverse auction and prices paid through traditional methods. One cannot conclude the reverse auction provides more or fewer savings, but simply that it does provide a savings compared to the price deemed fair and reasonable.

The reverse auction is also characterized as flexible. Agencies were able to limit the acquisitions to small businesses or open the competition to the full spectrum of vendors. The ability to introduce innovation into the acquisition process without inhibiting small business interests is a key aspect of the success of on-line reverse auctioning. Agencies were also able to access vendors worldwide. One reverse auction by an agency in Germany purchased computers from an industry leader in the United States.



Product	Extended Max Bid Price	Extended Final Bid Price	Total \$ Saved	% Saved
Laptops	\$14,000	\$6,560	\$7,440	53.14%
Eyepiece Assembly	\$550,000	\$261,500	\$288,500	52.45%
Notebook Computers	\$186,000	\$108,000	\$78,000	41.94%
Desktop Computers	\$197,000	\$115,000	\$82,000	41.62%
Office supplies	\$10,000	\$6,000	\$4,000	40.00%
Hardware for Messaging System	\$230,000	\$138,850	\$91,150	39.63%
Computers 800 MHz	\$41,000	\$24,900	\$16,100	39.27%
Hot Water Heaters	\$20,000	\$12,200	\$7,800	39.00%
PC Card	\$12,200	\$7,600	\$4,600	37.70%
Electrical Connector Plugs	\$118,000	\$78,000	\$40,000	33.90%
Computers 800 MHz	\$256,500	\$175,500	\$81,000	31.58%
Dishwashers	\$22,000	\$15,700	\$6,300	28.64%
Link Assembly part	\$207,900	\$149,000	\$58,900	28.33%
Computers 866 MHz	\$806,000	\$582,400	\$223,600	27.74%
Modular Office Buildings	\$24,000	\$17,400	\$6,600	27.50%
Computer Hardware	\$500,000	\$368,008	\$131,992	26.40%
Dishwashers, Ranges, Refrigerators	\$31,000	\$23,300	\$7,700	24.84%
Computers	\$266,000	\$205,800	\$60,200	22.63%
Zip Drives	\$4,950	\$3,900	\$1,050	21.21%
Secure Fax Machines	\$6,891	\$5,511	\$1,380	20.03%
Appliances	\$42,000	\$33,600	\$8,400	20.00%
Desktop Computers	\$147,000	\$118,000	\$29,000	19.73%
Computers 733 MHz	\$46,000	\$37,000	\$9,000	19.57%
Overhead Projector	\$4,100	\$3,300	\$800	19.51%
Goats	\$13,000	\$10,000	\$3,000	19.23%
Computers	\$334,900	\$275,800	\$59,100	17.65%
Collar Assembly part	\$145,425	\$121,500	\$23,925	16.45%
Color Printer	\$72,000	\$60,800	\$11,200	15.56%
Brake Link	\$114,100	\$98,000	\$16,100	14.11%
Paper	\$43,000	\$37,328	\$5,672	13.19%
Multipurpose Paper	\$22,500	\$19,700	\$2,800	12.44%
Fax Machines	\$2,500	\$2,200	\$300	12.00%
Computers	\$60,000	\$53,600	\$6,400	10.67%
Supplemental Armor	\$42,630	\$38,454	\$4,176	9.80%
Lumber	\$17,000	\$15,400	\$1,600	9.41%
Sun Microsystems	\$1,052,000	\$959,000	\$93,000	8.84%
Sun Equipment	\$1,847,000	\$1,717,500	\$129,500	7.01%
Desktop Computers	\$45,900	\$43,200	\$2,700	5.88%
DVD & Camcorder	\$8,200	\$7,800	\$400	4.88%
Grenade Launcher	\$11,500	\$10,990	\$510	4.43%
Tool Kits	\$90,000	\$89,500	\$500	0.56%
Hydraulic Wrench	\$434,280	\$434,280	\$0	0.00%
Photo Workshop	\$7,000	\$7,000	\$0	0.00%

Table 4.1 Total Savings [Ref. 17]

After nearly one year the initiative has proven the potential for savings exists. However, the program has not expanded the use of reverse auctions for services.

The potential for savings and flexibility of the system draw much attention. Other considerations exist besides savings. The contracting officer must maintain a balance between all competing demands. Dick Hunter, Vice-President for Fulfillment and Supply-Chain Management, points out the other side of reverse auctions.

So auctions are not a silver bullet. Auctions and exchanges have fueled the thinking that price is everything. But there is more to procurement of materials than just price. Quality, service, technology, responsiveness, and the willingness to improve common processes also are very critical to driving down the total cost of material. [Ref. 31]

THIS PAGE INTENTIONALLY LEFT BLANK

## V. CONCLUSIONS AND RECOMMENDATIONS

### A. CONCLUSIONS

The reverse auction represents a change to the way acquisitions are priced. A dynamic pricing model replaces the static model. The research concludes there are advantages to using a reverse auction and real monetary savings. This chapter presents conclusions from the data presented in Chapter III and the analysis from Chapter IV. The conclusions represent inferences and deductions made from the research. Conclusions are grouped in three categories: 1) description; 2) future use; and 3) savings.

The items acquired span a spectrum from Commercial Off The Shelf (COTS) to Military Specification (MILSPEC). The COTS items are readily available in the market place and are bought by non-Government buyers. The availability and demand of these products make them ideal for reverse auctions because there are many suppliers. The MILSPEC items are designed and built to a very specific military standard. However, the MILSPEC items reviewed in depth were not new requirements. They were previously acquired and the reverse auction was simply a replenishment buy. In this sense, the reverse auction is not the appropriate strategy for a new requirement built to a MILSPEC. It is appropriate for a MILSPEC item in which competition with proven ability to produce the specific item exists.

A second aspect of the description category is the criteria for selection. These reverse auctions chose Lowest Price Technically Acceptable (LPTA) as the selection criteria. LPTA is the most appropriate method because the strategy reduces or eliminates non-price factors in the evaluation. Non-price evaluation factors allow the selection to be more objective and streamlined.

The third aspect of the description category is the number of items acquired in a reverse auction. The range spans from one to the hundreds. The underlying premise is that higher numbers, combined requirements, may allow the Government to take advantage of Economic Order Quantities (EOQ). Success was not limited to small or large acquisitions, nor did a relationship exist between the savings rate and the quantity acquired.

The second category of conclusions revolves around the potential for the future use of reverse auctions. General Services Administration (GSA) vendors were used in all three cases reviewed. The research did not lead to insight pertaining to the entire sample of reverse auctions. Obviously, GSA vendors streamline the process when determining responsibility and responsiveness. Future use should expand past the sole use of GSA vendors. All of the auctions in the research were for goods. The reverse auction has not demonstrated the ability to acquire services. The increase in the amount of dollars spent for the acquisition of services make this a logical path to pursue. Finally, the research did not present the ability to acquire goods based on "Best Value." The most likely reason for this relates to the item description. Successful reverse auctions occur when the items are commercial in nature and easily defined. There is little room to innovate the production or add value other than in price.

The final category is savings. Savings were previously defined as the differential between the contracting officer's determination of a fair and reasonable price (max bid price) and the final bid price for award. The monetary difference represents savings to the command. The percentage of savings in each reverse auction ranged from zero to over 50%. The mean savings rate was 21.83%. The total savings achieved in the 43 reverse

auctions reviewed was \$1,606,395. This value equates to 19.82% dollars saved by the command while meeting the mission. A key aspect tied to the savings achieved is the necessity for competition. In the dynamic pricing arena, the perception that competition exists does not hold value. If only one vendor shows up, the bid price does not move below the maximum established prior to the auction. In two cases only one vendor participated in the auction and the savings achieved were zero. Zero savings means the item was acquired at the value deemed fair and reasonable.

Overall, the pilot program has been successful for the Army and sister services. Many lessons were learned. The process continues to get better because lessons learned were incorporated into the model. While there are limitations to its effective use, the attempt to innovate the acquisition process based on current commercial methods has put another tool in the acquisition toolkit.

## **B. ANSWERS TO RESEARCH QUESTIONS**

Chapters II and IV provided more insight to the research questions. Brief answers to the research questions are presented here.

### **1. Primary Research Question**

***What is the best use of a reverse auction as an acquisition tool by United States Army contracting agencies?***

The best use of a reverse auction is to use it as a pricing tool. The reverse auction does not relieve the contracting officer of any duties or responsibilities in the acquisition process. Reverse auctions are not "silver bullets" designed for use in all situations. Reverse auctions are a tactic to source non-strategic commodity items. Limitations and constraints affect the usefulness. The reverse auction simply allows vendors to assess their bid against the competition. Vendors are allowed to adjust their

bid to remain competitive for the award. This process refines the contracting officer's initial assessment of a fair and reasonable price. The process represents efficiency in establishing a fair and reasonable price.

The competitive nature of a reverse auction ensures the Government pays no more than what is fair and reasonable according to the current market conditions. The differential between the Government's assessment of the market and the actual market represents savings to the command.

## **2. Secondary Research Questions**

### ***a. What is a reverse auction?***

Essentially, a reverse auction is the opposite of an auction. Instead of many buyers bidding the price of something up, there are many sellers bidding the price down. In a reverse auction one buyer is offering his purchase for numerous sellers to bid for his patronage. The sellers successively bid the price down until no one is willing to offer a lower bid. Additionally, technology has allowed this process to be conducted on-line via a web-based interface in real time.

### ***b. What is a good candidate for reverse auction?***

The goods acquired ranged from COTS to MILSPEC. The overwhelming preponderance of items was COTS in nature. While a small percentage of the items were military in nature, a successful reverse auction would not include the acquisition of a newly developed, complicated MILSPEC system. The underlying premise is that the item is easily defined; competition exists for manufacturing and distributing the item; the civilian community readily acquires the items; and price is the determining selection factor. The selection does not include services at this time.

**c. *How is the opening bid price established?***

Historical prices paid adjusted for inflation, Independent Government Estimates, and market research provide the insight to establish competitive maximum bids. In essence, the same methods to determine a fair and reasonable price are used to establish the opening bid price.

**d. *Does a reverse auction provide savings to the Government?***

A reverse auction strategy seems to provide significant monetary savings. In the 43 auctions reviewed in this research, the mean savings was 21.83%. However, the research did not measure or conclude if any time savings were realized.

**e. *What factors must be considered in determining whether a requirement is suitable for use of reverse auction techniques?***

Three factors must be considered prior to using a reverse auction to acquire goods. First, the item description must resemble COTS. The closer the item is to COTS, the more likely a reverse auction approach is appropriate. Along with that is the priority of price in the selection (LPTA). Second, the ability to establish a fair and reasonable maximum bid price is essential to a successful reverse auction. If the price is established too low, vendors will not participate. Third, competition for the item must exist in the market place. Market research is essential to understanding the market for items. Market research helps determine the level of all three factors.

**f. *Are there any statutory issues associated with executing a reverse auction?***

The 1997 FAR rewrite removed the language that prohibited auctioning. However, reverse auction bidders must give their approval for their bids to be seen by competitors prior to the reverse auction commencing.



## **C. RECOMMENDATIONS**

### **1. Establish a Users Guide to the Army's Reverse Auction**

The Army's initiative to develop and implement use of an on-line reverse auction tool is one year old. The process and key players have changed over the course of the year. Unfortunately, there is not a single source guide for users to query. The personnel involved in the reverse auction on a daily basis represent the expertise in the field. Approximately one third of the auctions reviewed were conducted by Army activities. In order to expand the use of the reverse auction by Army activities, a user's guide should be written for dissemination. The guide can also help educate the contractor community better understand the process.

### **2. Expand the Use of Reverse Auctions to Acquire Services**

All of the auctions reviewed were for the acquisition of goods. Recently, the dollars spent by the Department of Defense (DOD) on services surpassed the amount spent on goods. The future use of the reverse auction in acquisition for services is a logical path. The use of performance specifications is a likely choice over detailed statements of work (SOW). The question is not whether to use or not use a reverse auction for the acquisition of services, but when. The research recommends reverse auction techniques be applied to the acquisition of services.

### **3. Minimize Future Policies Regarding the Use of Reverse Auctions**

The procedures for using a reverse auction strategy are still developing. Establishing the right user interface is a constant challenge. The process is simply still evolving. In order for the Army to maintain progress the tactics, techniques, and procedures must be developed. Any statutory or policy implementation restricting innovation with this process will have detrimental effects on its usefulness. The best

recommendation is to let the process evolve into a well-defined procedure before considering any policy regarding its use.

#### **D. AREAS FOR FURTHER RESEARCH**

##### **1. Future Reverse Auctions**

Future research in this area should attempt to capture other than monetary savings and efficiencies offered by the on-line reverse auction process. As well, research should analyze successive buys of similar items to assess any change in the savings rates realized compared to previous acquisitions.

##### **2. Reverse Auction Process Analysis**

Future research should analyze the on-line reverse auction process using a knowledge inference system in order to identify pathologies and remedies. The research should define and measure the current process and suggest changes to make the process more efficient.

##### **3. Contractor Perspective**

Future research should analyze the effect of reverse auctions on contractors, particularly small and disadvantaged businesses. The contractor's perspective would provide an insight to the process not currently expressed.

THIS PAGE INTENTIONALLY LEFT BLANK

## LIST OF REFERENCES

1. Tiedeman, Bob, "Breaking the Acquisition Paradigm: CECOM Acquisition Center Pilots Army's E-Auctions," *Army AL&T*, January-February 2001.
2. Commercial Business Environment Group, Department of Defense, "The Commercial Business Environment: Accelerating Change Through Enterprise Teaming," Government Printing Office, October 2000.
3. Notes From the Administrator, Statement of Deidre A. Lee, Administrator for Federal Procurement Policy before the Subcommittee on Government Management, Information, and Technology, Committee on Government Reform House of Representatives, [<http://www.arnet.gov/Notes/testimony.html>], 16 March 2000.
4. Wyld, David C., "The Auction Model: How the Public Sector Can Leverage the Power of E-Commerce Through Dynamic Pricing," October 2000.
5. Batstone, David, "Going Once, Going Twice...", *Business*, May 1999.
6. O'Malley, Chris, "Internet: Do I Hear a Bid?", *Popular Science*, November 1998.
7. *Webster's II New Riverside University Dictionary*, Riverside Publishing Company, 1994.
8. Chelekis, George C., *The Official Government Auction Guide*, Crown Publishers Company, 1992.
9. Roll, Bruce A., *Online Reverse Auctions: A Pricing Tool for Government Contracting*, Master's Thesis, Naval Postgraduate School, Monterey, California, December 2000.
10. Davidow, Emily, "The Dynamics of Pricing," *Home Textiles Today*, February 2000.
11. Coy, Peter, "Going, Going, Gone...Sucker! How the Winner's Curse Could Undermine Online Auctions," *Business Week*, 20 March, 2000.
12. Siebel Systems, [<http://www.siebel.com/eauction/webauction.html>], April 2000.
13. Schrage, Michael, "To Hal Varian: The Price Is Always Right," *Strategy & Business*, First Quarter 2000.

14. Merson, Ina R., "Reverse Auctions: An Overview," *Acquisition Directions Advisory*, July 2000.
15. Antonio, Robert, "Do Reverse Auctions Violate FAR 15.307(b)?," [<http://www.wifcon.com/anallegal.htm>], 24 July 2000.
16. Rivera, Carrie, "Opportunities and Increased Profits With Army Procurement Innovations," *Office World News*, v. 28, July 2000.
17. Electronic mail between M. Meinert, United States Army Communications-Electronics Command, Ft. Monmouth, NJ, and the author, 4 May 2001.
18. Robinson, Brian, "Shopping for the Right Model," *Federal Computer Week*, August 28, 2000.
19. *Contract Pricing Reference Guides Volumes I-V*, [[http://www.acq.osd.mil/dp/cpf/pgv1\\_0/index.html](http://www.acq.osd.mil/dp/cpf/pgv1_0/index.html)], April 2001.
20. Federal Acquisition Regulation System, *Federal Acquisition Regulation*, 7 August 2000.
21. Landsburg, Steven E., *Price Theory & Applications*, 4<sup>th</sup> ed., South-Western College Publishing, 1999.
22. Electronic mail between S. Anderson, United States Army Communications-Electronics Command, Fort Monmouth, NJ, and the author, 29 March 2001.
23. Electronic mail between J. Flatley, Frictionless Commerce Incorporated, Cambridge, MA, and the author, 23 May 2001.
24. Anonymous, United States Army Forces Command, "Principal Assistant Responsible for Contracting Online Bidding Guidance," 18 September 2000.
25. Anonymous, "FORSCOM's First Reverse Auction Conducted at Fort Hood," *Army Acquisition Reform Newsletter*, v. 6, 26 September 2000.
26. Electronic mail between S. Calderon, III Corps and Fort Hood Contracting Command, Fort Hood, TX, and the author, 12 January 2001.
27. Electronic mail between W. Jacques, United States Army Tank-automotive and Armaments Command, Warren, MI, and the author, 27 March 2001.
28. Electronic mail between P. Watkins, United States Army Tank-automotive and Armaments Command, Warren, MI, and the author, 24 May 2001.

29. Electronic mail between M. Hicks, 5<sup>th</sup> Signal Command, DCMCI-Southern Europe, and the author, 22 February 2001.
30. Telephone interview between M. Meinert, United States Army Communications-Electronics Command, Ft. Monmouth, NJ, and the author, 25 May 2001.
31. Sheridan, John H., "Proceed With Caution," *Industry Week*, v. 250, 12 February 2001.

THIS PAGE INTENTIONALLY LEFT BLANK

## INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center .....2  
8725 John J. Kingman Road, Suite 0944  
Ft. Belvoir, VA 22060-6218
2. Dudley Knox Library .....2  
Naval Postgraduate School  
411 Dyer Road  
Monterey, CA 93943-5101
3. Commander E. Cory Yoder .....2  
Code GSBPP/YC  
Naval Postgraduate School  
Monterey, CA 93943
4. Dr. Lee Edwards .....2  
Code GSBPP/ED  
Naval Postgraduate School  
Monterey, CA 93943
5. Dr. David V. Lamm .....3  
Code GSBPP/LT  
Naval Postgraduate School  
Monterey, CA 93943
6. Matthew Meinert.....2  
USACECOM  
Attn: AMSEL-AC  
Fort Monmouth, NJ 07703
7. Major Gary D. Stephens .....2  
215 Longwood Drive  
Huntsville, AL 35801